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9 October 2002

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 1

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached 2 copies of the Consent Order Plans and Reports, Volume 1. The plans provided in Volume 1 include:

- Project Management Plan
- Community Relations Plan
- Data Management Plan
- Institutional Control Plan

The submission of Volume 1 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b. The remaining reports will be submitted to the U.S. EPA in subsequent volumes.

If you have any questions or comments regarding Volume 1, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas Cornuet

Thomas S. Cornuet
Project Manager

Attachment
cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON

Community Relations Plan
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

October 2002

Prepared for

WYETH

Florham Park, New Jersey

Prepared by

Weston Solutions, Inc.
1400 Weston Way
West Chester, Pennsylvania 19380

W.O. No. 02994.002.009

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LIST OF ACRONYMS

AHP	American Home Products Corporation
CMI	Corrective Measures Investigation
CMS	Corrective Measures Study
DCE	Dichloroethene
GAC	Granular Activated Carbon
ICP	Institutional Control Plan
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SVE	Soil Vapor Extraction
TCA	Trichloroethane
TCE	Trichloroethene
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WKI	World Kitchen, Incorporated

1. INTRODUCTION

1.1 PLAN OBJECTIVES

The Community Relations Plan (CRP) for the Massillon, Ohio, World Kitchen, Inc.(WKI) plant (U.S. EPA ID #OHD 045-205-424) has been prepared to fulfill reporting requirements set forth in Section VI, Paragraph 15, Section, IX Paragraph 39b, and Section 2 and Table 1 of Attachment 2 of the Administrative Order on Consent (Consent Order) between the United States Environmental Protection Agency (U.S. EPA), WKI, and Wyeth (July 2002). This plan is based on guidance provided in the RCRA Corrective Action Plan (U.S. EPA, 1994). The purpose of this plan is to provide the appropriate mechanisms to distribute information regarding the investigation activities and results for this project.

There are several community relations techniques that will be utilized for the distribution of information regarding the RCRA Facilities Investigation (RFI), Corrective Measures Study (CMS), and the Corrective Measures Implementation (CMI) as directed by the Office of Waste Programs Enforcement (OSWER) of the U.S. EPA in the May 1994 Resource Conservation and Recovery Act (RCRA) Corrective Action Plan Guidance (Final) (OSWER Directive Number 9902.3-2A). These include establishing an information contact and an information repository, issuing fact sheets, and conducting public meetings with key people in the surrounding community, as appropriate. The following discussion presents the various community relations techniques that will be employed for the WKI (former EKCO), Massillon, Ohio, facility.

1.2 FACILITY OWNERSHIP

EKCO Housewares, Inc. owned and operated the Massillon, Ohio, facility until 1965, at which time it was acquired by American Home Products Corporation (AHP). AHP continued to operate the facility until 1984 when it was sold to the EKCO Group. In 1999, the EKCO Group sold the facility to WKI, the current owner of the property. AHP changed its name to Wyeth in March 2002.

1.3 FACILITY DESCRIPTION

The facility occupies approximately 13 acres in the City of Massillon, Stark County, Ohio (Figure 1-1). The area surrounding the site is largely urban and industrial. Land use to the northwest is more rural with more open space. The property is triangular in shape and lies approximately 1,500 ft west of the Tuscarawas River. The facility is bordered to the north by Newman Creek, while the Penn Central and the Baltimore and Ohio Railroads border the property to the west and east, respectively. The Baltimore and Ohio Railroad has numerous spurs and sidetracks adjacent to the plant, which are used for the storage of rail cars and track maintenance vehicles.

Manufacturing, warehousing, and shipping activities are conducted within a complex of interconnected buildings, which cover approximately 5.6 acres of the 13-acre site. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas. The building locations are shown on Figure 1-2.

A variety of businesses operate in the immediate vicinity of the plant, including: Ohio Packaging (paper supplier) to the south, sand and gravel quarries to the west and northwest, Carter Lumber (retail) and Price Brothers, Inc. (concrete pipe) to the north, and the Consumer Water Service (public water supply) waterworks and an automobile reclamation site to the east and northeast. An inactive municipal landfill reportedly exists just east of Consumer Water Service. The City of Massillon is believed to have been the principal user of the landfill; however, other users may also have been involved. The landfill was apparently informally operated, that is, no weigh station or access control was believed to have been present, and the landfill was not fenced. It is unclear whether records of ownership, methods of operation, or methods of "closure" have been retained.

1.4 FACILITY HISTORY

The first recorded activities occurred at the facility in approximately 1929, when the property was owned by Standard Oil Company. From approximately 1929 to 1942 Fort Pitt/Massillon Bridge Works manufactured iron and steel bridges and structural iron. In 1945, the Massillon

FIGURE 1-1 SITE LOCATION MAP
WORLD KITCHEN, INC. (EKCO) FACILITY
MASSILLON, OHIO

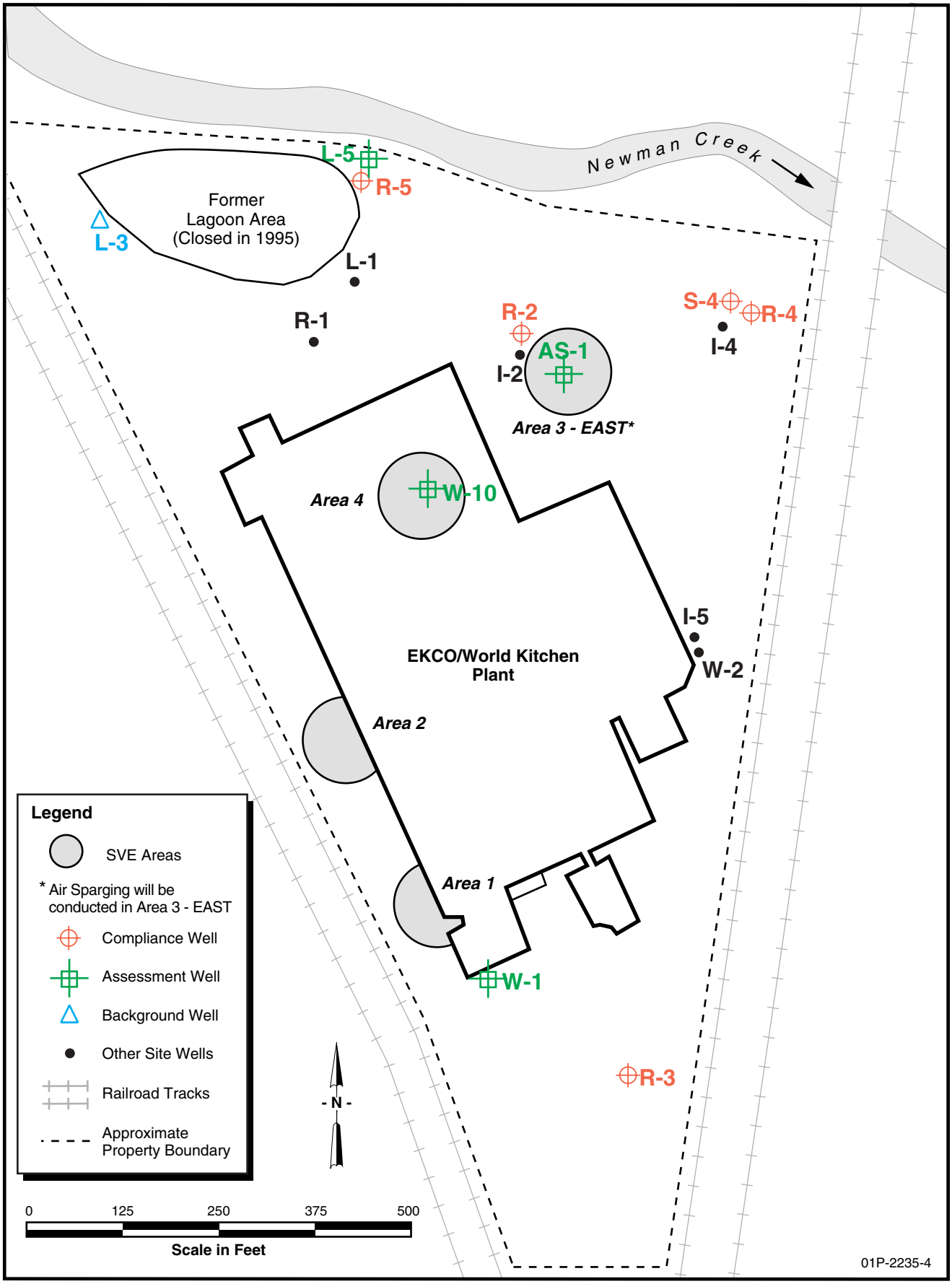


FIGURE 1-2 EKCO – MASSILLON, OHIO PROJECT GROUNDWATER MONITORING PROGRAM WELLS AND SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING AREAS

facility was manufacturing aluminum and stainless steel cookware. By 1951, with the United States' involvement in the Korean Conflict, the plant was manufacturing 90 mm and 105 mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells, W-1 and W-2, at the facility (Figure 1-2). In 1953, a sewer was constructed which carried the plant waste to a discharge point along Newman Creek. At approximately the same time, a surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Wastewaters from manufacturing were discharged to the surface impoundment.

During 1954, the facility began alternate manufacturing operations. The primary function of these operations was returned to manufacturing cookware at the facility. Solvents (primarily trichloroethene [TCE] or 1,1,1-trichloroethane [1,1,1-TCA]) were used to clean the products prior to continuing production. These solvents were used for cleaning purposes until 1994. In 1994, the solvents were replaced with a Borax aqueous cleaner which is still used at the facility. No chlorinated solvents have been used at the facility since 1994.

By 1967, trends in the cookware manufacturing industry had changed, resulting in the installation of porcelain- and Teflon-coating units. In 1969, with the development of new NPDES regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to accept waste products associated with plant activities. These waste products have included:

- Deionizers from plant operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain-Teflon-coated aluminum cookware (aluminum frit, various coloring inorganics oxides, lead, cadmium, selenium, cobalt).
- Alkaline washer fluids to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued for the facility. As the 1970's progressed, the facility discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper-coating operations had ended and the principal products manufactured at the facility became pressed and coated non-stick bakeware.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the Corrective Measures Study (CMS). This correction is based on more recent review of historical plant documents.

The surface impoundment was reactivated in 1980 under the existing NPDES permit, and received housing degreaser filter water until mid-1984. The surface impoundment was finally decommissioned in December 1985. In March 1984, when the plant applied for a renewal of their NPDES permit, analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at the facility. The waste stream was diverted from the surface impoundment to discharge in Newman Creek in December 1985. At that time, the surface impoundment (lagoon) was permanently taken out of service.

In 1992, the facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area. During 1993 and 1994, Roy F. Weston, Inc. (WESTON®) was retained by AHP to pursue a clean closure for the lagoon. Closure activities were conducted at the site from August 1993 to June 1994. A closure certification report was submitted to the OEPA in July 1994, and approval of the lagoon closure was issued in January 1995. Now that the lagoon is officially closed, quarterly groundwater sampling of the lagoon wells is no longer required for the RCRA lagoon closure.

WKI (formerly EKCO) continues to manufacture pressed and coated non-stick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface. A detailed description of the historical environmental investigations and a table summarizing the facility history are provided in the Community Relations Plan (Consent Order Reports and Plans, Vol. 1).

2. ENVIRONMENTAL INVESTIGATIONS

This section provides detailed descriptions of the environmental investigations conducted at the WKI (former EKCO) facility. A summary of these environmental investigative activities is presented in Table 2-1. Floyd Brown and Associates, Inc. (FBA) conducted the first environmental investigations at the facility between 1984 and 1987. WESTON has conducted all subsequent environmental investigations at the facility. These investigations are discussed below.

2.1 1984-1987 INVESTIGATIONS

In 1984, with the discovery of 1,1,1-trichloroethane (TCA) and trichloroethene (TCE) in the groundwater production wells, the facility initiated an environmental investigation. During the months of September and October 1984, seven test borings were drilled by Ohio Drilling, Inc. Four test borings (TH-1-84 through TH-4-84) were drilled into the shallow overburden, while the remaining three (TH-5-84 through TH-7-84) were drilled through the overburden and into the underlying bedrock. Locations of the soil borings and monitor wells used during the historical investigations are shown on Figure 2-1. Soil and water samples were collected from all seven locations, and analyses revealed varying levels of VOCs. Two of the shallow test borings (TH-1-84 and TH-2-84) were completed as 1¼-inch inside diameter (I.D.) piezometers (designated as P-1-84 and P-2-84, respectively), while the remaining two borings were plugged. All three of the open-hole bedrock boreholes were completed with 6-inch casing to bedrock and were designated R-1 through R-3. Dedicated pumps were installed in each of these wells. Analysis of groundwater samples obtained from these wells in 1984 detected VOCs, including TCE and dichloroethene (DCE). An additional bedrock well (R-4) was installed in July 1985, along the eastern property boundary. No VOCs were detected in samples collected from this well.

Because production well W-10 was centrally located on the propert

y, it was decided that a pump-and-treat program utilizing this well would be initiated at the facility to control migration of VOCs and to remediate the VOCs detected in groundwater. With the concurrence of Ohio EPA, an air stripper was installed by Ohio Drilling, Inc. to treat the groundwater recovered by the pumping of well W-10 and put into service in February 1986.

Table 2-1

Summary of Site History and Environmental Activities

Date	Site Activity
Circa 1929-32	First recorded activities at facility. Property is owned by Standard Oil Company.
Circa 1929-42	Fort Pitt/Massillon Bridge Works – Manufacture of iron and steel bridges and structural iron.
1945	Manufacturing aluminum and stainless steel cookware. (Well W-10 installed in 1943.)
1951	With the U.S. involvement in the Korean Conflict, the plant began manufacturing 90-mm and 105-mm shell casings for the military. This increase in production necessitates the drilling of two additional production wells (W-1 and W-2). Well W-1 has been used continuously since then, and well W-2 was used until it was taken out of service in the late 1970s.
1953	A surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Sludge frame waste treatment was discharged to it. Began copper-plating cookware; used primarily TCE or 1,1,1-TCA to clean cookware.
1965	AHP acquired EKCO Housewares.
1967	Installation of porcelain and Teflon coating units.
1969	Surface impoundment meets newly formed NPDES regulations and permits.
1973	The only major documented solvent spill to date at the facility was recorded.
July 1974	NPDES Permit No. C-3094BD was issued for the facility.
1977	The facility discontinued the manufacturing of aluminum and porcelain cookware and the use of the lagoon ceased.
1978	All copper plating operations ended; the principal manufactured products were pressed and coated nonstick bakeware.
1980	The surface impoundments were reactivated under the existing NPDES permit and received alkaline degreaser filter water.
March 1984	In applying for a renewal of their NPDES permit, the plant was required to analyze on-site well water for VOCs; this analysis indicated the presence of 1,1,1-TCA and TCE.
June 1984	All discharges to lagoon ceased.
1984	AHP sold EKCO Housewares to the EKCO Group.
Fall 1984	Seven soil borings were drilled; four in the overburden and three in the bedrock. Two of the overburden holes were completed as 1¼-inch (I.D.) piezometers and the three bedrock holes were completed as 6-inch (I.D. casing) bedrock wells (R-1 through R-3).

Table 2-1 (Continued)

Summary of Site History and Environmental Activities

Date	Site Activity
July 1985	An additional bedrock well (R-4) was installed along the eastern boundary. No VOCs were found.
February 1986	An air stripper was installed on-site and put into service. The discharge of the stripper was directed to Newman Creek.
June 1986	Floyd Brown Associates (FBA) developed a preliminary closure plan for the lagoon. Phase I of the plan called for 12 soil borings. No VOCs were detected in any of the borings.
January/February 1987	A more intensive soil boring program (Phase II) was conducted by FBA. The program consisted of 25 soil borings. Four of the borings were completed as 1 ½ -inch (I.D.) PVC wells to monitor the lagoon.
July 1987	WESTON was contracted to develop a final closure program for the lagoon and to develop a groundwater quality assessment program.
September 1987	WESTON conducted a baseline assessment of the facility which included sampling of all on-site wells, including Ohio Water Service (OWS) well #4, collecting OVA readings, well construction information and water level measurements, surveying on-site wells, groundwater utilization survey and a review of plant records.
February 1988	WESTON began monthly sampling of OWS wells #1, 2, 3, and 5. These wells were sampled until March 1990.
June/July 1988	Installation of 13 monitor wells, eight of which were installed to characterize the stratigraphy of water-bearing zones, to determine the depth of bedrock and to assess the hydraulic interconnection between the unconsolidated sand, gravel and clay aquifer and the Pottsville sandstone. The other five wells were installed in accordance with RCRA Part 265, Subpart F, for surface impoundment closure.
December 1988	WESTON performed a soil gas survey to identify potentially contaminated areas. Soil borings identified by the soil gas survey were advanced to determine the vertical extent of any contamination. WESTON also sampled all on-site wells, including the on-site production wells.
May 1989	WESTON began the quarterly sampling of the five lagoon wells (L-1 through L-5).
April 1991	WESTON conducted packer tests to evaluate the extent of interconnection between overburden and bedrock wells.
June/August 1991	WESTON installed 13 monitor wells to evaluate off-site groundwater conditions.
September 1991	WESTON sampled all monitor wells and production wells.
March 1992	WESTON sampled all monitor wells and production wells.

Table 2-1 (Continued)

Summary of Site History and Environmental Activities

Date	Site Activity
May 1992	The facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area.
May 1993	WESTON submitted the Final RFI Report to the USEPA.
August 1993	WESTON initiated lagoon closure activities at the site.
September 1993	WESTON submitted the CMS Report to the USEPA.
November 1993	USEPA approved the Final RFI Report.
November 1993	USEPA approved the CMS Report with changes.
April/May 1994	WESTON conducted Interim Remedial Measures which included the rehabilitation of observation wells R-1, R-2, and R-3 and production wells W-1, W-2, and W-10, and abandoned well D-4-30.
June 1994	WESTON submitted a notice to OEPA announcing that the lagoon closure activities were completed.
July 1994	WESTON submitted to the U.S. EPA a CMS Addendum that incorporated the findings of the Interim Remedial Measures.
November 1994	WESTON submitted a Baseline Health Risk Assessment Report to the USEPA.
January 1995	OEPA determined that the lagoon had been closed in accordance with the approved Closure Plan and Rules 3745-66-12 through 3745-66-15 of the Ohio Administrative Code.
May 1995	WESTON and AHP received direction from OEPA and USEPA that the quarterly groundwater sampling that had been conducted since 1989 was no longer required due to the official closure of the lagoon. A modified groundwater sampling program was implemented.
April 1996	USEPA issued the Draft Statement of Basis which explained the proposed remedy for cleaning up the site.
August/September 1996	USEPA accepted comments from the public on the Draft Statement of Basis for the site.
September 1996	USEPA held a public meeting to present the Draft Statement of Basis for the site.
September 1996	AHP and WESTON submitted comments on the Draft Statement of Basis for the site to the USEPA.
September 1999	World Kitchen, Incorporated (WKI) purchased the EKCO facility from the EKCO Group.
August 2000	USEPA requested that new soil cleanup goals be calculated using the EPA Soil Screening Guidance.

Table 2-1 (Continued)

Summary of Site History and Environmental Activities

Date	Site Activity
September 2000	AHP and WESTON calculated new soil cleanup goals and collected 54 soil samples from 19 soil borings to evaluate current soil contaminant concentrations at the site.
November 2000	AHP and WESTON submitted a Draft Soil Investigation Report to the USEPA, presenting the results of the September 2000 soil sampling.
December 2000	USEPA provided comments on the Draft Soil Investigation Report.
February 2001	AHP and WESTON completed the Final Soil Investigation Report.
March 2002	AHP changed its name to Wyeth.
26 August 2002	Administrative Order on Consent for the WKI Massillon, Ohio, facility (U.S. EPA ID #OHD045-205-424) executed with U.S. EPA, WKI, and Wyeth
Present	WKI (formerly EKCO) continues to manufacture pressed and coated nonstick bakeware. Contaminated groundwater is contained on-site and extracted using wells W-1 and W-10 and treated with the on-site air stripper system.

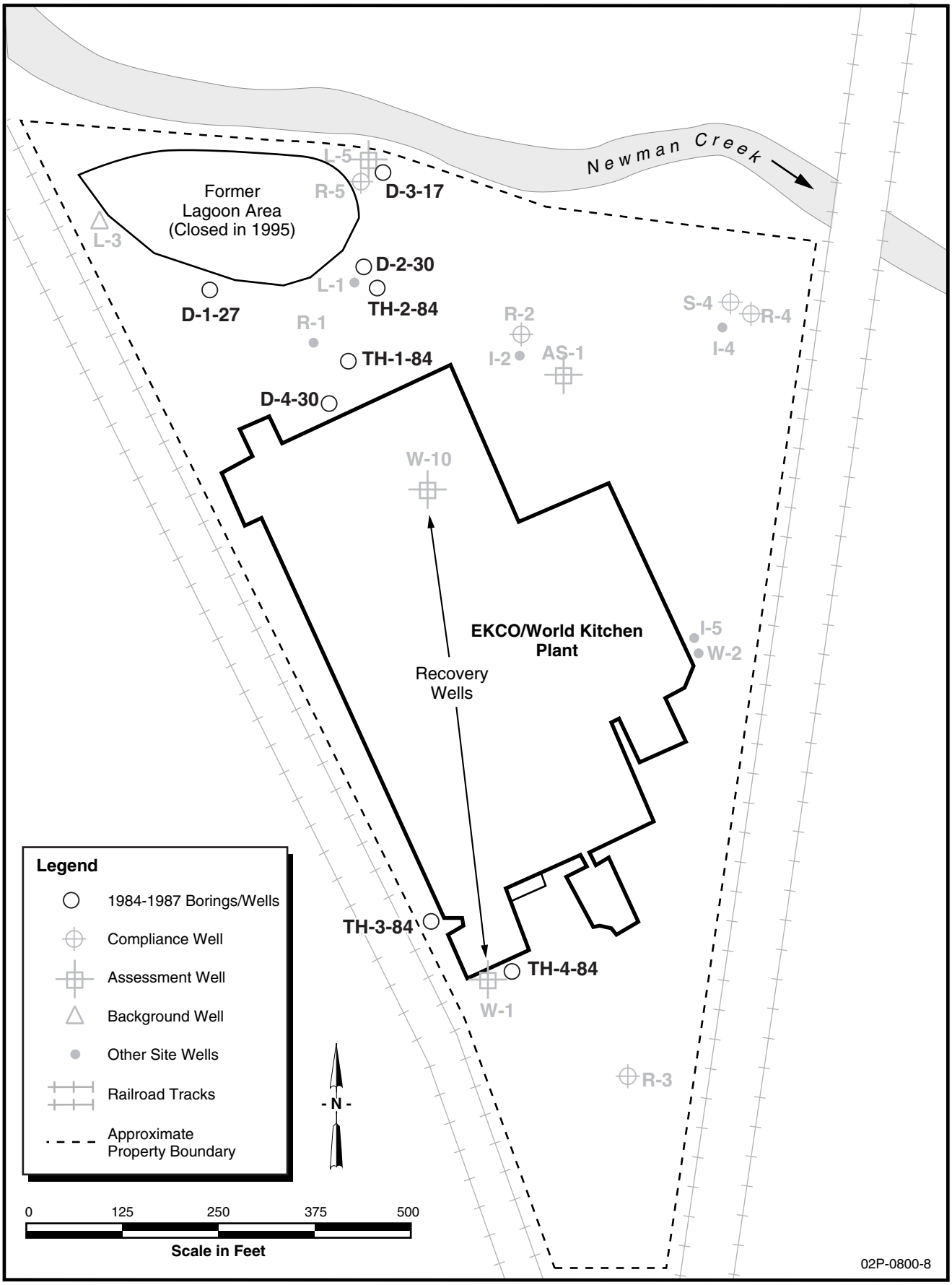


FIGURE 2-1 LOCATIONS OF OLD ABANDONED SOIL BORINGS AND WELLS USED 1984-1987

On 17 June 1986, FBA developed a preliminary closure plan for the lagoon. The closure plan led to a Phase I screening investigation of the lagoon, which involved the drilling and collection of composite samples from 12 soil borings. Laboratory analyses of soil samples from this program indicated elevated levels of cadmium, chromium, and lead in soil samples collected within the lagoon and in locations between the lagoon and Newman Creek. No VOCs were detected in any of the soil samples. See the *Groundwater Quality Assessment Plan for EKCO Housewares* (WESTON, March 1988) for a summary review of FBA's analytical results and the locations of these wells and borings.

The Phase I investigation led to a more intensive Phase II soil boring program conducted by FBA in January and February 1987. The program involved completion of 25 additional soil borings. Four of these soil borings (D-1-27, D-2-30, D-3-17, and D-4-30) were completed as 1½-inch I.D. PVC monitor wells. Analytical results indicated elevated concentrations of cadmium, chromium, and lead in soils to the maximum depth of the borings. However, these concentrations were localized in the area near the inlet of the lagoon. Maximum concentrations near the ground surface of 8,400 mg/kg cadmium, 2,630 mg/kg chromium, and 19,500 mg/kg lead were detected.

2.2 1987- PRESENT INVESTIGATIONS

In July 1987, WESTON was retained by AHP to develop a final closure plan for the lagoon for submittal to the Ohio EPA and a groundwater quality assessment program for the entire facility. In September 1987, WESTON conducted an interim measures assessment to collect baseline information and to determine the need for interim corrective measures. This included the following activities:

- Sampling of Ohio Water Service Well No. 4 and all on-site wells (except the out-of-service process water well, W-2) to establish baseline data for each well and to collect well data (e.g., organic vapor analysis [OVA] readings, construction details, depth to water measurements, etc.).
- Surveying all on-site wells.
- Conducting a groundwater utilization survey which included identifying and locating domestic, commercial and municipal wells within a 1-mile radius of the facility.
- Reviewing plant records and other available documents, which included aerial photographs, tax maps and geologic references.

VOCs were detected in the on-site overburden and bedrock groundwater monitor wells. The primary compounds detected were TCE, 1,1,1-TCA and their breakdown products. The results of the initial investigation are presented in WESTON's *Interim Measures Report*, dated February 1988. WESTON recommended that on-site pumpage be increased, if practical, in order to enhance contaminant recovery and hydraulic control of groundwater underlying the plant.

WESTON initiated a groundwater quality assessment program (GWQAP) for the facility during the summer of 1988. The primary purpose of this effort was to address groundwater conditions at the facility proceeding under Section 3008(h) of the RCRA of 1976, as amended, U.S.C. 6928(h), and as part of the closure plan for the surface impoundment facility, particularly in reference to 40 CFR Section 265.93. The results of this program are presented in the *Groundwater Quality Assessment Report* (WESTON, 1990).

A RCRA Facility Investigation (RFI) was conducted at the facility to fully evaluate the horizontal and vertical extent of contamination for the entire site. Details of the RFI Scope of Work are outlined in the RFI Work Plan (WESTON, 1990) and the field work was conducted during 1991 and 1992. The Final RFI Report fully discusses the results of the RFI investigation and was submitted to the USEPA in May 1993 and approved in November 1993.

This work was performed in accordance with an Administrative Order on Consent (Consent Order), signed between the facility and the USEPA in March/April 1989. The Draft CMS Report was initiated shortly after the Final RFI Report was approved and submitted to the USEPA in September 1993. In November 1993, the USEPA approved the CMS with changes. In July 1994, WESTON submitted to the USEPA a draft addendum to the CMS Report. This addendum addressed the impacts of the Interim Remedial Measures conducted at the site in April and May 1994.

In 1992, WESTON was retained by AHP to pursue a clean closure plan for the lagoon. The Lagoon Closure Work Plan was submitted to the Ohio EPA in October 1992 and approved on 13 July 1993. Closure activities were initiated at the site on 24 August 1993. On 1 June 1994, WESTON submitted a notice to the Ohio EPA announcing that the lagoon closure activities were completed. The results of the lagoon closure are presented in the Lagoon Closure Certification Report for the

facility, which was submitted to the Ohio EPA in July 1994. On 9 January 1995, AHP received official notice that the Ohio EPA had determined that the lagoon had been closed in accordance with the approved plan and Rules 3745-66-12 through 3745-66-15 of the Ohio Administrative Code.

WESTON conducted well rehabilitation Interim Remedial Measures (IRM) activities at the facility from 21 March through 29 April 1994. This work was performed pursuant to the Draft IRM Work Plan, which was submitted to the USEPA Region V on behalf of AHP in December 1993 and approved by the USEPA Region V in February 1994. The results of these activities were submitted to USEPA in the June 1994 *Draft Report Interim Remedial Measures*. The results of the IRM are summarized below.

Rehabilitation of six on-site bedrock wells was performed by properly sealing the well casings against confining layers present in the side walls of the boreholes. This rehabilitation work was designed to eliminate inter-aquifer communication and contaminant migration between the shallow overburden aquifer and the bedrock aquifer beneath the site. The on-site bedrock wells requiring rehabilitation included production/recovery wells W-1 and W-10 and out-of-service production well W-2, and monitor wells R-1, R-2, and R-3. Shallow overburden monitor well D-4-30 was abandoned by overdrilling and grouting the borehole in accordance with the Ohio Department of Natural Resources (ODNR) regulations for well abandonment. Because of the siltation problems associated with the poor condition of the wellhead seal and casing riser, the agency recommended the abandonment of this well. Following completion of rehabilitation activities, monitoring of the groundwater levels in all water-bearing units was performed to assess the extent to which the pumping of the site recovery wells continue to affect the aquifer gradients and capture zones.

The results of the post-rehabilitation groundwater monitoring indicated that the groundwater flow direction in the four primary water-bearing units in the area of the site continues to be toward the site production/recovery wells, W-1 and W-10. The most significant changes in groundwater levels occurred in the bedrock water-bearing zone. Specifically, the retrofitted R-wells exhibited significant drops in water level elevations.

WESTON conducted a baseline Health Risk Assessment (HHRA) at the request of USEPA Region V. The objective was to assess health risks to a hypothetical future on-site resident from exposure to

VOCs. The final document was submitted on 23 November 1994 and incorporated revisions that were requested by USEPA Region V on 24 October 1994. No additional comments have been received from the agency concerning the HHRA.

In May 1995, WESTON and AHP received direction from Ohio EPA and USEPA that the quarterly groundwater sampling that had been conducted since 1989 was no longer required due to the official closure of the lagoon. A modified groundwater sampling program was implemented. This program consists of sampling four R-wells (R-2 through R-5) once every 6 months during February and August, and sampling two L-wells (L-4 and L-5) once every year during February.

In April 1996, the USEPA issued a Draft Statement of Basis (SB), which explained the proposed remedy for cleaning up the site, and presented it at a public meeting in September 1996. In August 2000, the USEPA requested that new soil cleanup goals be calculated for the site, using the USEPA Soil Screening Guidance (USEPA, 1996). The USEPA requested that new soil cleanup goals be calculated for the two contaminants, TCE and cis-1,2-dichloroethen (1,2-DCE), which were exceeded in the CMS report, plus two additional contaminants, 1,1-dichloroethene (1,1-DCE) and 1,1,1-TCA.

In September 2000, WESTON submitted revised soil cleanup goals to the USEPA and collected 54 soil samples from 19 soil borings to evaluate current soil contaminant concentrations at the site. In November 2000, WESTON submitted a Draft Soil Investigation Report to the USEPA, presenting the results of the September 2000 soil investigation. The USEPA provided comments on the report in December 2000, and WESTON completed a Final Soil Investigation Report in February 2001.

3. SELECTED CLEANUP PLAN

RFI results show that soil and groundwater contaminated with VOCs at the facility should be remediated. A number of alternatives for cleaning up soil and groundwater contamination were identified and evaluated during the CMS. The alternatives are described and compared in detail in the CMS report, which is available for review at the information repository listed in Section 5.

3.1 REMEDIATION OBJECTIVES

Objectives for cleanup at the facility include:

- Achieving regulatory standards for VOCs detected in soil and groundwater at the facility.
- Continuing the prevention of contaminant migration from the facility property.

The selected alternative, which will successfully meet all of these objectives, is scheduled for implementation beginning in the fall of 2002.

3.2 SELECTED CORRECTIVE MEASURES ALTERNATIVES

Based on the CMS (November 1993) and the CMS Addendum (July 1994), the U.S. EPA has identified and approved the alternatives that will most effectively clean up VOCs at the facility. The selected cleanup alternatives include measures for cleaning up groundwater and identified areas of soil, including one area beneath and three areas outside the facility building. The site monitor wells and remediation areas are shown in Figure 1-2. The selected alternatives consist of the components discussed below.

VOCs in the shallow groundwater in Area 3-East will be removed by a process called "air sparging" (AS), also known as "in situ air stripping." AS is an effective option for treating groundwater contaminated with VOCs. The process transfers VOCs, which evaporate easily when exposed to air, from a liquid to a vapor phase. A system of injection wells injects air into groundwater. VOCs dissolved in the groundwater will volatilize into the air as the air bubbles move through the impacted groundwater. Soil vapor extraction (SVE) wells are then used to

collect vapor-phase VOCs as they migrate upward through the soil subsurface. Once contaminated vapors are removed from the soil subsurface, they are treated using a vapor treatment system such as granular activated carbon (GAC) filters, if necessary.

There is a groundwater extraction and air stripping system currently being used at the facility, which will continue to be operated to provide further groundwater containment and treatment beneath the entire site. Groundwater will continue to be monitored to ensure the effectiveness of treatment. Well permit restrictions and institutional controls will be placed on the property to restrict the placement and pumping of water supply wells in or near the area of the contaminated groundwater, and to restrict the facility to non-residential water use only. The institutional controls and restrictions are further described in the Institutional Control Plan (Consent Order Reports and Plans Vol. I).

VOC-impacted soil as located beneath and outside the building will be treated by an SVE system to remove VOCs using the same process described above. Air extraction vents will be installed in each contaminated soil area. The removed VOCs will be treated using GAC filters, if necessary. SVE vents will be installed into all four areas, Area-1, Area-2, Area-3 East, and Area-4, to a total depth of approximately 10 to 25 ft below ground surface (bgs). SVE blowers will be used to create a vacuum on each of the vents and remove contaminants from the subsurface. The system will include monitoring parts, gauges, and valves throughout the system so that contaminant load, pressures, and flow rates can be monitored and adjusted to evaluate and optimize system performance. The AS and SVE operation and maintenance procedures will be described in the Operation and Maintenance Plan.

3.3 PROJECT SCHEDULE AND ESTIMATED BUDGET

The project schedule as required by the Consent Order is depicted below.

Event	Due Date*
Execution of Consent Order	26 Aug. 2002
Designate a Project Manager for Wyeth, WKI, and U.S. EPA	14 days
Wyeth, WKI, and U.S. EPA must each designate a Project Manager and notify each other in writing	14 days
WKI must submit a Deed Notice to Stark County	45 days
Submit a Community Relations Plan	45 days

Event	Due Date*
Submit an Institutional Control Plan	45 days
Submit a Project Management Plan	45 days
Submit a Data Management Plan	45 days
Submit a Sampling and Analysis Plan	60 days
Submit a Quality Assurance Project Plan	60 days
Submit a Site Health and Safety Plan	60 days
Submit first Progress Report and submit quarterly thereafter	60 days
Submit a cost estimate to complete work	90 days
Begin quarterly groundwater monitoring program for first 5 years and semi-annually thereafter**	90 days
Submit a Design Report for implementing IS-2, OS-3, and GW-6	90 days
Complete construction and begin operation of IS-2, OS-3, and GW-6***	12 months
Submit a Construction Completion Report and Operation and Maintenance Plan for IS-2, OS-3, and GW-6	15 months
Provide financial security within 30 days of U.S. EPA approval of cost estimate	U.S. EPA Dependent

* Due date is the time from the execution date of the Consent Order.

** Or other schedule as approved by U.S. EPA.

***IS-2: Indoor Soil Remediation Alternative No. 2
OS-3: Outdoor Soil Remediation Alternative No. 3
GW-6: Groundwater Remediation Alternative No. 6

Based on the CMS (November 1993) and the CMS Addendum (July 1994), the total estimated cost for treating contaminated groundwater is $3,259,700. The total estimated costs for treating contaminated soil is $771,000 for soil beneath the building, and $1,340,000 for soil outside the building. The site remediation areas are shown in Figure 1-2.

4. INFORMATION CONTACTS

The following individuals will serve as information contacts for their respective parties during the execution of the Consent Order:

- Matthew Basso, Wyeth, will provide responses to questions directed to Wyeth, a former owner of the facility.

- Jeff Burman, WKI, is the local contact person with the current property owner. He will be available to respond to questions from residents, state and local officials, citizens' groups, and the media.

- Ken Bardo, U.S. EPA, will provide accurate responses to questions directed to the principal enforcement agency overseeing the CMI.

- Tom Cornuet, WESTON, will provide responses to questions directed to the contractor with primary responsibility for the design and implementation of the CMI.

The contact information is provided below.

Name/Title	Company	Address	Phone/Fax	e-mail
Matt Basso/Project Manager	Wyeth	100 Campus Dr., Florham Park, NJ 07932	Ph: (973)683-2273 Fax: (973) 683-2281	bassom@wyeth.com
Jeff Burman/Project Manager.	WKI	359 State St. ext. NW, Massillon, OH 44648	Ph: (330) 832-5026 Fax: (330) 833-8003	BurmanJL@WorldKitchen.com
Ken Bardo/Project Manager	U.S. EPA (V)	77 W. Jackson Blvd, Chicago, IL 60604	Ph: (312) 886-7566 Fax: (312) 353-4342	Bardo.kenneth@epa.gov
Tom Cornuet/Technical Consultant Leader	WESTON	1400 Weston Way, West Chester, PA 19380	Ph: (610) 701-7360 Fax: (610) 701-7401	tom.cornuet@westonsolutions.com
Eric Lang/ Laboratory Manager	Severn Trent Laboratory	2417 Bond St. University Park, IL 60466	Ph.: (708) 534-5200 Fax: (708) 534-5211	Elang@STL-inc.com

5. INFORMATION REPOSITORY

An information repository has been established for the project at the Massillon, Ohio, Public Library. The repository ensures that accurate, understandable information is available to interested parties. Fact Sheets, final site reports/work plans, and general information on the RCRA CMI have been and will continue to be kept in the repository. The location and phone number of the repository are provided below:

Massillon Public Library
208 Lincoln Way East
Massillon, OH 44648
(330) 832-9831

On behalf of Wyeth and WKI, WESTON will submit to the project information repository final copies of the following reports after they are approved by the U.S. EPA:

- Operation and Maintenance Plan
- Construction Completion Report
- Air Sparging Remediation Report
- Air Sparging Performance Monitoring Report
- Soil Remediation Report
- Groundwater Remediation Report
- Groundwater Performance Monitoring Report

Other pertinent project reports will also be submitted to the repository as they are available.

6. FACT SHEETS

Fact Sheets provide a mechanism for communicating to the media and general public accurate, factual information about the RFI, CMS, and CMI activities, site findings, and project developments as they occur. Fact Sheets typically provide basic information about the regulations, the site, and the activities, including significant findings and any significant developments that occur during the CMI process.

A draft site-specific Fact Sheet was developed to summarize the findings from the RFI and CMS studies conducted previously and the selected cleanup plan for the facility. This draft Fact Sheet is provided in Appendix A. Fact Sheets will be prepared, as appropriate, that summarize the progress of site activities during the CMI. The Fact Sheets will be available for review in the document repository. WKI will provide adjacent landowners and affected state and local governments copies of the Fact Sheets in order to notify them of the pump-and-treat groundwater remedy for the facility.

7. PUBLIC MEETINGS

If requested by USEPA, public meetings will be held at the completion of key phases of the CMI project. The meetings will be open to the general public. The time, date, and place of any scheduled public meetings would be announced in local newspapers and at the facility. A recent Fact Sheet prepared during the course of the CMI will be available to meeting participants. USEPA, Wyeth, WKI, and/or WESTON will be prepared to present information of interest regarding the program. Following the presentation, time will be allotted for an open forum question and answer session.

8. REFERENCES

U.S. EPA, Office of Solid Waste, Office of Waste Programs Enforcement.1994. *RCRA Corrective Action Plan.* OSWER Dir. 9902.3-2A.

U.S. EPA. Office of Solid Waste and Emergency Response. April 1996. *Soil Screening Guidance: User's Guide.* OSWER Dir. 9355.4-23.

Roy F. Weston, Inc. February 2001. "Final Soil Investigation Report for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. November 2000. "Draft Soil Investigation Report for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. June 1994. "Draft Report Interim Remedial Measures for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1993. "Addendum to the Corrective Measures Study for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1993. "Corrective Measures Study for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1993. "RCRA Facility Investigation Report for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1990. "Groundwater Quality Assessment Report for EKCO Housewares, Inc., Massillon, Ohio." Prepared for U.S. EPA Region V and Ohio EPA, Waste Management Division.

Roy F. Weston, Inc. 1990. "RCRA Facility Investigation Report for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1988. "Interim Measures Report for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1988. "Groundwater Quality Assessment Plan for EKCO Housewares, Inc., Massillon, Ohio." Prepared for U.S. EPA Region V and Ohio EPA, Waste Management Division.

APPENDIX A
DRAFT OCTOBER 2002 FACT SHEET

THIS FACT SHEET DISCUSSES THE FOLLOWING:

- The history of the former EKCO Housewares, Inc., facility
- Investigations conducted at the facility
- Potential health risks posed by facility contamination
- The selected cleanup plan
- Public participation in selecting a cleanup remedy
- Glossary

CLEANUP PLAN SELECTED

Before selecting a final cleanup remedy for the former EKCO facility, EPA solicited input from the community on all of the cleanup alternatives evaluated, as well as its proposed cleanup plan. EPA set a public comment period from August 26 – September 26, 1996 to give the public an opportunity to submit formal comments and participate in the cleanup selection process. Written comments were submitted to EPA. The EPA responded to all comments that were received in the Final Decision on April 23 2001, which is available for public review, along with other facility-related documents in the administrative record, located at the address listed on the last page of this fact sheet.

CLEANUP PLAN SELECTED FOR CONTAMINATION AT THE FORMER EKCO HOUSEWARES, INC. FACILITY

Massillon, Stark County, Ohio **October 2002**

INTRODUCTION

This fact sheet is provided by Wyeth and World Kitchen, Inc. (WKI) and presents the U.S. Environmental Protection Agency's (EPA) selected remedy for cleaning up contaminated soil and groundwater at the former EKCO Housewares, Inc. (EKCO), facility in Massillon, Ohio and also briefly explains the reasons for selecting the proposed remedy. In September 1999, the EKCO facility was purchased by WKI, and WKI currently owns and operates the facility. EPA selected the cleanup plan for the WKI (former EKCO) facility after the public was given the opportunity to comment on the proposed cleanup plan and all other cleanup alternatives considered for the facility.

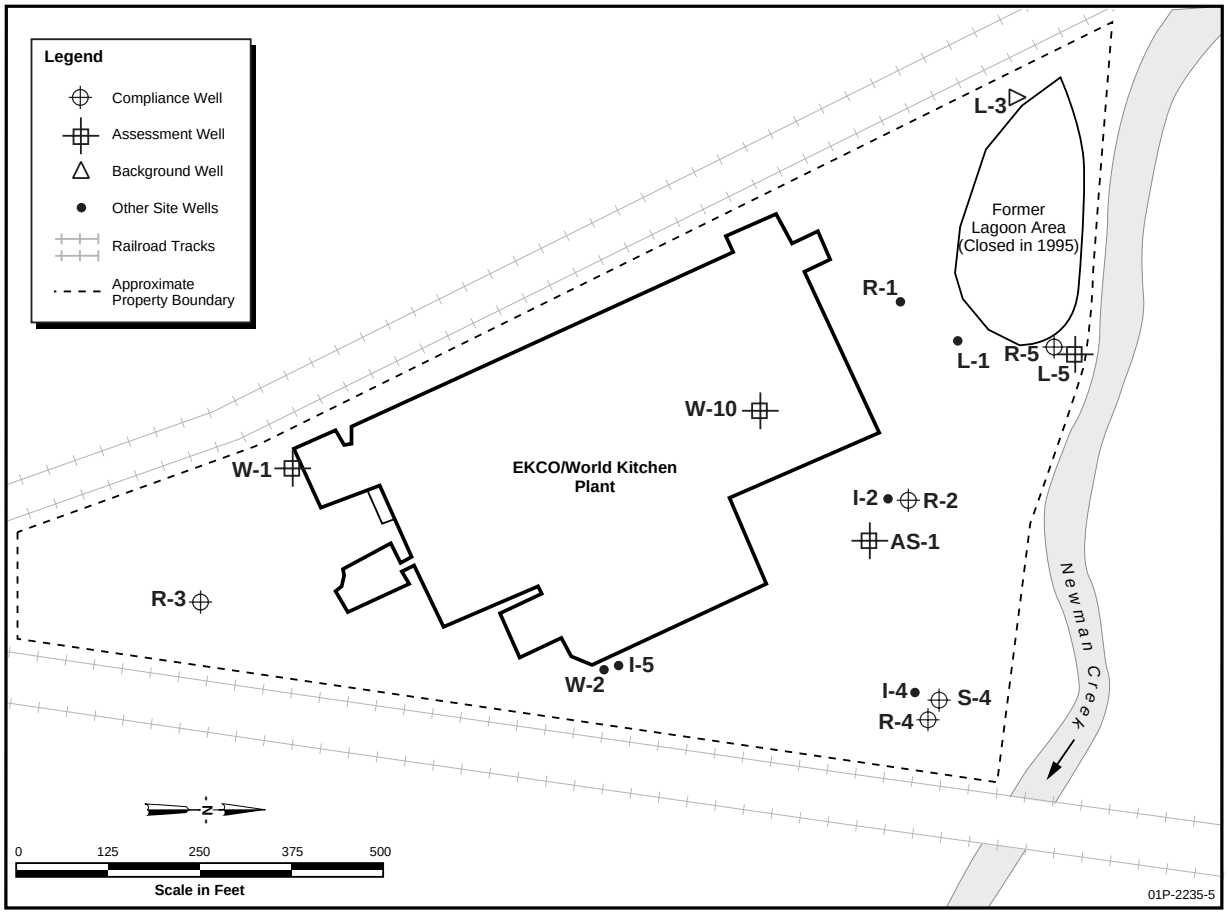
This fact sheet is based on information obtained from a public document called the Final Decision, which EPA requires to fulfill public participation requirements under Section 3008(h) of the **Resource Conservation and Recovery Act** (RCRA). (Words in **boldface** are defined in the glossary on Page 5.) The Final Decision summarizes environmental investigation reports prepared for the WKI facility that are available for public review along with other facility-related documents in the **administrative record**, which is located at the address listed on the last page of this fact sheet. EPA encourages the public to review these documents to gain a better understanding of the WKI facility and activities that have been conducted there.

FACILITY HISTORY

The WKI facility (former EKCO facility) is located on approximately 13 acres in Massillon, Start County, Ohio. The area surrounding the facility is largely urban and industrial. The property lies an estimated 1,500 feet west of the Tuscarawas River and is bordered to the north by Newman Creek and to the south, east and west by railroad tracks. A map of the facility is shown below.

In the 1940's, the facility manufactured aluminum and stainless steel cookware. By 1951, the facility was also manufacturing shell casings for the military. Increased production led to the drilling of two production wells at the facility. In 1953, the facility installed a sewer to carry plant waste to a discharge point along Newman Creek and also constructed a lagoon (**surface impoundment)** adjacent to the creek. Waste associated with plant activities and sludge from waste treatment were discharged to the surface impoundment. The surface impoundment was used from 1953 to 1977 and from 1980 to 1984. In 1954, EKCO began coating the cookware manufactured at the facility. From 1954 to 1960, the facility used solvents, which contained **volatile organic compounds (VOCs),** in the cleaning process prior to coating. Porcelain and Teflon coating units were installed in 1976. In 1994, the facility replaced VOC solvents with a Borax aqueous solution.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. In 1992, a 330-gallon spill was reported to have occurred in the west side of the facility. In 1984, water in the production wells was sampled and analyzed. VOCs were detected in the groundwater samples, indicating that VOCs had migrated from soil into groundwater.



WORLD KITCHEN, INC., FACILITY MAP

DRAFT

ENVIRONMENTAL INVESTIGATIONS

The facility began an environmental investigation in 1984. Soil and water samples were collected from seven locations around the facility. Samples contained various concentrations of VOCs. To control **migration** of the VOCs and remediate groundwater, a **pump-and-treat** program was initiated at production well W-10. An **air stripping** system was installed to treat the groundwater recovered from well W-10.

In June 1986, the facility began development of a preliminary closure plan for the lagoon. In September 1987, a groundwater quality assessment was conducted to collect baseline information and determine the need for interim cleanup measures at the facility. VOCs were detected in groundwater samples from on-site **monitoring wells** installed in both shallow soils and **bedrock.** A groundwater quality assessment program was started in 1988 to evaluate groundwater conditions at the facility.

In 1989, EPA and the facility signed a **consent agreement** under which the facility agreed to conduct a **RCRA facility investigation (RFI)**. RFI field activities began in April 1991 and included groundwater, surface water, soil and soil gas sampling. RFI results indicate that the main sources of VOC contamination are located near well W-10 and the tank area north of the facility. On-site groundwater is contaminated and groundwater contamination has been detected off-site, north and east of the facility. Based on information gathered during the RFI, the facility conducted a **corrective measures study** (CMS) to identify and evaluate alternatives for cleaning up facility contamination. An estimated 3,500 cubic yards of contaminated soil is located under the facility building, and 4,900 cubic yards of contaminated soil is located outside the building on the facility property.

HEALTH RISKS

As part of the CMS, a study called a "baseline risk assessment" was conducted to determine potential risks to human health and the environment posed by contamination at the facility based on the conditions present at the facility during the RFI. Specifically, the study assesses health risks to people who might live on the property in the future if groundwater or soil contamination is not remediated and the existing groundwater pump-and-treat system is no longer used. However, the Final Cleanup Plan for the site includes operation of the existing groundwater treatment system until drinking water standards are met for all site contaminants. Health risks were evaluated based on exposure to VOCs present in groundwater in the shallow and intermediate portions of the bedrock (the upper groundwater unit) and the lower portion of the bedrock (the lower groundwater unit).

The baseline risk assessment evaluated two types of human health risks: carcinogenic risks and noncarcinogenic risks. Carcinogenic risk is expressed in terms of the increased likelihood that additional cases of cancer could potentially develop in a population as a result of exposure to cancer-causing contaminants over a lifetime. Noncarcinogenic risk is expressed in terms of whether adverse health effects other than cancer could potentially be caused by exposure to contaminants.

Overall, the greatest risks posed by the facility would result from on-site residents drinking groundwater and breathing in contaminants while showering in groundwater. The results of the baseline risk assessment show that VOCs in the upper groundwater unit at the facility pose a lifetime cancer risk of $1x10^{-2}$, meaning that the potential exists for 1 future resident at the property out of 100 to develop cancer as a result of exposure to contaminants in the upper groundwater unit if no cleanup measures are taken at the facility. The assessment also showed that the potential exists for 1 future resident out of 1,000 to develop cancer (expressed as a risk of $1x10^{-3}$) as a result of exposure to contaminants in the groundwater unit if no cleanup measures are taken. In addition, the risk assessment showed that exposure to contaminants in the upper and lower groundwater units would pose potential noncancer health risks as well.

In accordance with EPA and federal law requirements, cleanup actions must be taken at sites or facilities that pose potential cancer risks of greater than 1 in 10,000 (expressed as $1x10^{-4}$) or that pose potential adverse noncancer risks. Therefore, cleanup actions are required and underway at the facility.

THE SELECTED CLEANUP PLAN

RFI results show that soil and groundwater contaminated with VOCs at the facility should be cleaned up. A number of alternatives were identified and evaluated for cleaning up soil and groundwater contamination during the CMS. All of the alternatives are described and compared in detail in the CMS report, which is available for review at the location listed on the last page of this fact sheet.

Based on the CMS, EPA has identified the alternative that it believes is best for cleaning up VOCs at the facility. The selected cleanup alternative includes measures for cleaning up groundwater and two areas of soil at the facility beneath and outside the facility building. The selected alternative consists of the components discussed below.

VOCs in groundwater will be removed by a process called "air sparging" (AS), also known as **"in situ** air stripping." AS is an effective option for treating groundwater contaminated with VOCs. The process basically transfers VOCs, which evaporate easily when exposed to air, from a liquid to a vapor phase. A system of injection wells injects air into groundwater. VOCs are dissolved in the groundwater and volatilize into the air as air bubbles. **Soil vapor extraction (SVE)** wells are then used to collect vapor-phase VOCs as they migrate upward through the soil subsurface. Once contaminated vapors are removed from the soil subsurface, they are treated using a vapor treatment system such as **granular activated carbon (GAC)** filters.

The air stripping currently being used at the facility will continue to be operated to provide further groundwater treatment. Groundwater will be monitored to ensure the effectiveness of treatment. Well permit restrictions and institutional controls will be placed on the property to restrict the placement of drinking wells in the area of the contaminated groundwater, and to restrict the facility to non-residential use only.

VOC-contaminated soil both beneath and outside the building will be treated by an SVE system to remove VOCs using the same process as described above. Air extraction vents will be installed in each contaminated soil area. The removed VOCs will be treated using GAC, if necessary.

The total estimated cost for treating contaminated groundwater is $3,259,700. The total estimated costs for treating contaminated soil is $771,000 for treating soil beneath the building, and $1,340,000 for treating soil outside the building.

Objectives for cleanup at the facility include (1) meeting regulatory standards for VOCs detected in all groundwater zones at the facility, (2) continuing the prevention of contaminant migration from the facility property, and (3) meeting regulatory standards for VOCs detected in soil. The selected alternative will successfully meet all of these objectives, and construction is scheduled to begin in the Fall of 2002.

PUBLIC PARTICIPATION

Before selecting a final cleanup remedy for the facility, EPA solicited input from the community on all of the cleanup alternatives evaluated in the CMS, as well as on its proposed cleanup plan. *EPA set a public comment period from August 26 through September 26, 1996, to give the public an opportunity to submit formal comments and participate in the cleanup selection process.* Written comments were submitted to EPA at the addresses listed on the last page. After consideration of the comments received, EPA selected the final cleanup plan and documented the selection in a document called a "Response to Comments (RTC)," which is available to the public at the location listed on the last page. Public comments were summarized in the RTC.

GLOSSARY

Administrative record: A file that is maintained and contains all information used by the lead agency to make its decision on the selection of a response action. The file is available for public review.

Air stripping: A treatment system that removes, or strips, volatile organic compounds (VOCs) from contaminated groundwater or surface water by forcing an air stream through the water and causing the VOCs to evaporate.

Bedrock: A term applied to solid rock underlying soil.

Consent agreement: A legal agreement between the U.S. Environmental Protection Agency (EPA) and the party potentially responsible for contaminating a site or facility whereby the party agrees to perform or pay the cost of a site or facility cleanup. This agreement describes actions to be taken at the site or facility and may be subject to a public comment period.

Corrective measures study (CMS): A study that develops and evaluates alternatives for addressing contamination at a RCRA facility.

Granular activated carbon: A treated material that attracts VOCs.

In situ: A term meaning "in place." An in situ treatment system treats material in place without requiring excavation, removal, or transport.

Migration: The uncontrolled movement of a contaminant or contaminants from one location to another.

Monitoring wells: A special well drilled at a specific location on or off a hazardous waste site from which groundwater can be sampled at selected depths to determine the direction of groundwater flow and the types and amounts of contaminants present in groundwater.

Resource Conservation and Recovery Act (RCRA): A federal law that established a regulatory system to track hazardous wastes from the time they are generated to the time they are disposed. The law requires that safe and secure procedures be used to treat, transport, store, and dispose of hazardous wastes. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

RCRA facility investigation (RFI): An investigation that evaluates the nature and extent of releases of hazardous waste and hazardous constituents at a facility and that gathers necessary data to support the corrective measures study and interim protective measures.

Surface impoundment: A pond used to treat, store, or dispose of liquid hazardous wastes.

Volatile organic compound: A organic (carbon-containing) compound that evaporates readily at room temperature.

FOR MORE INFORMATION

If you would like more information about the former EKCO facility or have questions, please contact one of the following project representatives:

Matt Basso
Project Manager
Wyeth
100 Campus Dr.
Florham Park, NJ 07932
(973) 683-2273

Jeff Burman
Project Manager
World Kitchen, Inc.
359 State St., Ext. NW
Massillon, OH 44648
(330) 832-5026

Ken Bardo
Project Manager
U.S. Environmental Protection
Agency, Region 5 (DRE-8J)
77 W. Jackson Blvd.
Chicago, IL 60604
(312) 886-7568

Tom Cornuet
Technical Consultant Leader
Weston Solutions, Inc.
1400 Weston Way
West Chester, PA 19380
(610) 701-7360

The administrative record, a record of all the information used or considered in making cleanup decisions at the facility, including the RFI and CMS reports and the Statement of Basis, is available for public review at the following location:

Massillon Public Library
208 Lincoln Way East
Massillon, OH 44648
(216) 832-9831

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 • Fax 610-701-3186
www.westonsolutions.com

9 October 2002

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 1

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached 2 copies of the Consent Order Plans and Reports, Volume 1. The plans provided in Volume 1 include:

- Project Management Plan
- Community Relations Plan
- Data Management Plan
- Institutional Control Plan

The submission of Volume 1 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b. The remaining reports will be submitted to the U.S. EPA in subsequent volumes.

If you have any questions or comments regarding Volume 1, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas Cornuet

Thomas S. Cornuet
Project Manager

Attachment
cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON

Data Management Plan
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

October 2002

Prepared for

WYETH

Florham Park, New Jersey

Prepared by

Weston Solutions, Inc.
1400 Weston Way
West Chester, Pennsylvania 19380

W.O. No. 02994.002.009

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LIST OF ACRONYMS

AHP	American Home Products Corporation
CMI	Corrective Measures Investigation
CMS	Corrective Measures Study
DCE	Dichloroethene
GAC	Granular Activated Carbon
ICP	Institutional Control Plan
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SVE	Soil Vapor Extraction
TCA	Trichloroethane
TCE	Trichloroethene
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WKI	World Kitchen, Incorporated

1. INTRODUCTION

1.1 PLAN OBJECTIVES

The Data Management Plan for the Massillon, Ohio, World Kitchen, Inc. (WKI) plant (U.S. EPA ID #OHD 045-205-424) has been prepared to fulfill reporting requirements set forth in Section VI, Paragraph 15, Section IX, Paragraph 39b, and Section 2 and Table 1 in Attachment 2 of the Administrative Order on Consent (AOC) between the United States Environmental Protection Agency (U.S. EPA), WKI, and Wyeth (26 August 2002). This plan is based on guidance provided in the Resource Conservation and Recovery Act (RCRA) Corrective Action Plan (U.S. EPA, 1994). The purpose of this plan is to provide a summary of the following:

- Facility Ownership
- Facility Description.
- Facility History.
- Documentation and Tracking of Remediation Data.
- Sample Identification Codes.
- Data Documentation Materials and Procedures.
- Project File Requirements.
- Progress Reporting Procedures.
- Project Team Responsibilities and Contact Information.

1.2 FACILITY OWNERSHIP

EKCO Housewares, Inc. owned and operated the Massillon, Ohio, facility until 1965, at which time it was acquired by American Home Products Corporation (AHP). AHP continued to operate the facility until 1984 when it was sold to the EKCO Group. In 1999, the EKCO Group sold the facility to WKI, the current owner of the property. AHP changed its name to Wyeth in March 2002.

1.3 SITE DESCRIPTION

The facility occupies approximately 13 acres in the City of Massillon, Stark County, Ohio (Figure 1-1). The area surrounding the site is largely urban and industrial. Land use to the

FIGURE 1-1 SITE LOCATION MAP
WORLD KITCHEN, INC. (EKCO) FACILITY
MASSILLON, OHIO

northwest is more rural with more open space. The property is triangular in shape and lies approximately 1,500 ft west of the Tuscarawas River. The facility is bordered to the north by Newman Creek, while the Penn Central and the Baltimore and Ohio Railroads border the property to the west and east, respectively. The Baltimore and Ohio Railroad has numerous spurs and sidetracks adjacent to the plant, which are used for the storage of rail cars and track maintenance vehicles.

Manufacturing, warehousing, and shipping activities are conducted within a complex of interconnected buildings, which cover approximately 5.6 acres of the 13-acre site. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas. The building locations are shown on Figure 1-2.

A variety of businesses operate in the immediate vicinity of the plant, including: Ohio Packaging (paper supplier) to the south, sand and gravel quarries to the west and northwest, Carter Lumber (retail) and Price Brothers, Inc. (concrete pipe) to the north, and the Consumer Water Service (public water supply) waterworks and an automobile reclamation site to the east and northeast. An inactive municipal landfill reportedly exists just east of Consumer Water Service. The City of Massillon is believed to have been the principal user of the landfill; however, other users may also have been involved. The landfill was apparently informally operated, that is, no weigh station or access control was believed to have been present, and the landfill was not fenced. It is unclear whether records of ownership, methods of operation, or methods of "closure" have been retained.

1.4 FACILITY HISTORY

The first recorded activities occurred at the facility in approximately 1929, when the property was owned by Standard Oil Company. From approximately 1929 to 1942 Fort Pitt/Massillon Bridge Works manufactured iron and steel bridges and structural iron. In 1945, the Massillon facility was manufacturing aluminum and stainless steel cookware. By 1951, with the United States' involvement in the Korean Conflict, the plant was manufacturing 90 mm and 105 mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells, W-1 and W-2, at the facility (Figure 1-2). In 1953, a sewer was constructed which carried the plant waste to a discharge point along Newman Creek. At approximately the

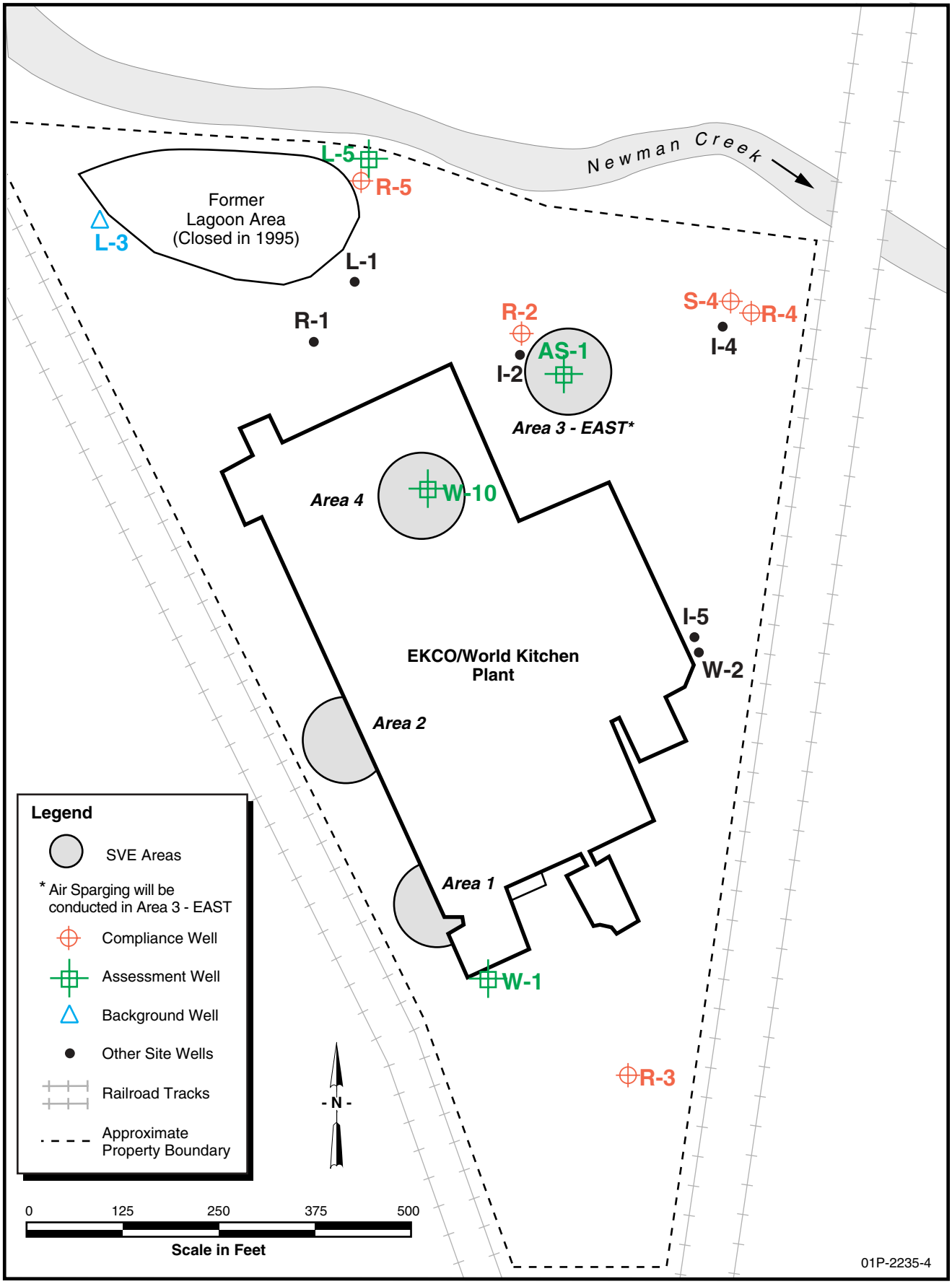

FIGURE 1-2 EKCO – MASSILLON, OHIO PROJECT GROUNDWATER MONITORING PROGRAM WELLS AND SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING AREAS

same time, a surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Wastewaters from manufacturing were discharged to the surface impoundment.

During 1954, the facility began alternate manufacturing operations. The primary function of these operations was returned to manufacturing cookware at the facility. Solvents (primarily trichloroethene [TCE] or 1,1,1-trichloroethane [1,1,1-TCA]) were used to clean the products prior to continuing production. These solvents were used for cleaning purposes until 1994. In 1994, the solvents were replaced with a Borax aqueous cleaner which is still used at the facility. No chlorinated solvents have been used at the facility since 1994.

By 1967, trends in the cookware manufacturing industry had changed, resulting in the installation of porcelain- and Teflon-coating units. In 1969, with the development of new NPDES regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to accept waste products associated with plant activities. These waste products have included:

- Deionizers from plant operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain-Teflon-coated aluminum cookware (aluminum frit, various coloring inorganics oxides, lead, cadmium, selenium, cobalt).
- Alkaline washer fluids to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued for the facility. As the 1970's progressed, the facility discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper-coating operations had ended and the principal products manufactured at the facility became pressed and coated non-stick bakeware.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the Corrective Measures Study (CMS). This correction is based on more recent review of historical documents.

The surface impoundment was reactivated in 1980 under the existing NPDES permit, and received housing degreaser filter water until mid-1984. The surface impoundment was finally decommissioned in December 1985. In March 1984, when the plant applied for a renewal of their NPDES permit, analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at the facility. The waste stream was diverted from the surface impoundment to discharge in Newman Creek in December 1985. At that time, the surface impoundment (lagoon) was permanently taken out of service.

In 1992, the facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area. During 1993 and 1994, Roy F. Weston, Inc. (WESTON®) was retained by AHP to pursue a clean closure for the lagoon. Closure activities were conducted at the site from August 1993 to June 1994. A closure certification report was submitted to the OEPA in July 1994, and approval of the lagoon closure was issued in January 1995. Now that the lagoon is officially closed, quarterly groundwater sampling of the lagoon wells is no longer required for the RCRA lagoon closure.

WKI (formerly EKCO) continues to manufacture pressed and coated non-stick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface. A detailed description of the historical environmental investigations and a table summarizing the facility history are provided in the Community Relations Plan (Consent Order Reports and Plans, Vol. 1).

2. DATA DOCUMENTATION

2.1 SAMPLE NAMING PROTOCOL

A unique field sample identification code will be assigned to each sample collected. For water samples, the identification code will consist of the following three parts separated by hyphens:

Part 1		Part 2		Part 3
XXXX	-	XXXXXX	-	XX
Location Identification	-	Collection Date Identification	-	Sample Type Identification

For soil samples, the identification codes will consist of the following five parts separated by hyphens:

Part 1		Part 2		Part 3		Part 4		Part 5
XXXX	-	XX	-	XX	-	XXXXXX	-	XX
Location Identification	-	Start Depth Identification	-	End Depth Identification	-	Collection Date Identification	-	Sample Type Identification

<u>Location Identification</u>

The *Location Identification Code* will not exceed four characters in length, and will be unique identifiers consisting of character codes that describe the sample type and location. Table 2-1 lists and describes some of the location identification codes available. Please note that numbers 1 through 9 shall be written as two-dig numbers (i.e., 01 through 09).

Table 2-1

Location Identification Codes

Location ID	Description
AS01	Assessment Well AS-1
I02	Site well I-2
I04	Site well I-4
I05	Site well I-5
L01	Site well L-1
L03	Background well L-3
L05	Assessment well L-5
R01	Site well R-1
R02	Compliance Well R-2
R03	Compliance Well R-3
R04	Compliance Well R-4
R05	Compliance Well R-5
S04	Compliance Well S-4
W01	Assessment well W-1
W02	Site Well W-2
W10	Assessment well W-10

Collection Date

The *Collection Date* portion of the sample identification code will not exceed six characters in length. The six-character date code will be:

MMDDYY

-MM—signifies a two-digit numeric code representing the month the sample was collected (01=January, 02=February, 03=March, 04=April, 05=May, 06=June, 07=July, 08=August, 09=September, 10=October, 11=November, 12=December).

-DD—signifies a two-digit numeric code representing the day the sample was collected. Valid values will include numbers from 01 to 31.

-YY—signifies a two-digit numeric code representing the year the sample was collected (i.e., – 02= 2002, 03=2003, etc.)..

Sample Type

The *Sample Type* will be a two-digit number representing the sample quality control (QC) type. Table 2-2 lists and describes the possible QC types.

Table 2-2

QC Codes and Descriptions

QC Code	Description
01	Normal Sample
02	Field Duplicate Sample
03	Equipment Blank Sample
04	Trip Blank Sample

Start Depth and End Depth

Start Depth and End Depth information for soil samples will be included in the *Sample Identification Code*. The starting and ending depths of a sample will be expressed in feet, separated by a hyphen (e.g., 02-04 represents a starting depth of 2 feet and an ending depth of 4 feet). All depths shall be rounded to the nearest whole number. No decimal points are to be used in the sample identification code.

2.2 FIELD DATA

Field Log Book

Data collection activities performed at the facility will be documented in a field log book. The entries will be detailed, descriptive, so that a particular situation can be recalled without reliance on the collector's memory.

The cover of each log book should contain the following information, as appropriate:

- Person to whom the book is assigned.
- Project name.
- Project work order number.
- Start date.
- End date.

The following procedures for setting up and using a field log book should be followed:

The title page of each log book should contain the following information as appropriate:

- Person and name of organization to whom the book is assigned
- Book number
- Project work order number
- Location and Activity
- Start date
- End date

Entries into the log book should contain the following information as appropriate:

- Date and time.
- Name of individual making the entry.
- Description of test/activity.
- Quantities of materials used.
- Drawings and information related to activity.
- Conditions that might adversely affect the test/activity.
- Names of witnesses or observers present.
- Samples collected, received, or released.
- Deviations from the procedures used or followed.
- Data that are not recorded by automatic methods.
- Calculations performed.
- Deviations from procedures, plans, or protocols used.
- Date and reason for downtime or delays.
- Visitors.
- Weather condition.

Geologic/Drilling Log

Drilling information will be recorded into the field notebook (paper or digital) and transferred to a geologic drill log. A separate log will be maintained for each boring. Instrument readings from the organic vapor meter (OVM), organic vapor analyzer (OVA), and/or combustible gas indicator (CGI) used for health and safety monitoring will be recorded in the notes column of the log. Upon completion of the field work, the drill log information may be entered into a computer database as appropriate.

Well Construction Data

Well construction details will be documented in a field log book with the following information, as appropriate:

- Drilling method.
- Borehole total depth.
- Borehole diameter.
- Screen depth (top and bottom).
- Screen diameter.
- Screen material.
- Sand pack depth (top and bottom - tagged with tape at time of placement).
- Sand pack material (number and commercial name).
- Bentonite seal depth (top and bottom - tagged with tape at time of placement).
- Bentonite seal mixture (specification and commercial name).
- Grout depth (bottom).
- Grout mixture (specifications and commercial name).
- Protective casing depth (bottom and stick-up).
- Riser depth (bottom and stick-up).
- Riser material.
- Amounts of all materials used in well construction.
- Calculated volume versus actual volume of sand pack, bentonite seal, and grout used.

The well construction information may be entered into a computer database and presented in a printed format to include the survey information of location and elevation of the top of the well riser data as appropriate.

Field Measurement Data

Measurements of field parameters will be recorded in the field log book in the following manner, as appropriate.

- The individual recording data will document the following, as appropriate:
  - Date, time and individual performing the measurements.
  - Sample location.
  - Weather conditions.
  - Parameter to be measured.
  - Model number of instrument used.
  - Calibration performed, including readings from calibration checks performed.

- The field measurements on samples will include the following information, as appropriate:

  - Parameter.
  - Time.
  - Reading.

- The units to be used for water quality parameters will include the following and/or others, as appropriate:

  - pH units to the tenths decimal place.
  - Water level in feet to the one-hundredths decimal place.
  - Temperature in degrees Celsius, to the tenth of a degree.
  - Conductivity in Fmhos to the tenths place.
  - Turbidity in NTUs to the ones place.
  - Dissolved oxygen in mg/liter to the ones place.
  - Organic vapors in units above background to the tenths decimal place.
  - Lower explosive limit in percent to the tenths decimal place.

Sample Collection Information

Samples collected will be recorded in the field log book with the following information, as appropriate:

- Sample location.
- Depth of sample collection.
- Sample matrix.
- Sample identification number.
- Date and time of collection.
- Any unusual appearances of the sample.
- Parameters to be analyzed.
- Date and time sample was released or received.

Chain-of-Custody Record

A chain-of-custody (COC) record will be filled out for each sample as it is collected by the field sampler to maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory. Each time the samples are transferred, the signatures of the persons relinquishing and receiving the samples, as well as the date and time of transfer, will be documented. The COC will include the following information, as appropriate:

- Project name.
- Collection date and time.
- Sample identification code.
- Sample volume and preservatives.
- Sample analyses.
- Name(s) of sampler(s).
- Name of person relinquishing samples.
- Name of person (or establishment e.g., Federal Express) delivering the samples.
- Airbill number, if applicable, to be placed in the comment section of the COC.
- Name of laboratory sample custodian accepting the samples.
- Date and time samples were accepted by laboratory.

COC seals are used to determine if any tampering has occurred during shipment of samples. These signed and dated seals will be placed at the junction between the lid and the jar, and between the cooler lid and cooler on all sample containers and shipment containers (coolers) by the person responsible for packaging. If the coolers or jars are opened before receipt at the laboratory, the seals will not be intact. If the COC seals are not intact, the laboratory project manager will notify the field manager within 24 hours of container receipt.

2.3 LABORATORY DATA

Analytical reports comprise final results (uncorrected for blanks and recoveries, unless specified), methods of analysis, levels of reporting, laboratory QC data, and supporting instrument data. In addition, special analytical problems will be noted in the case narratives. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two or three significant figures. Data are normally reported in units commonly used for the analyses performed.

Concentrations in liquids are expressed in terms of weight or activity per unit volume (e.g., micrograms per liter [µg/L], or milligrams per liter [mg/L]). Concentrations in solid or semisolid matrices are expressed in terms of weight or activity per unit weight of sample (e.g., micrograms per kilogram [µg/kg], or milligrams per kilogram [mg/kg]). Solid and semisolid matrices will also be reported on a dry weight basis. Reporting limits take into account all appropriate concentration, dilution, and/or extraction factors.

If any analytical anomalies were encountered during the analyses (e.g., a matrix duplicate that significantly deviates from expected analytical control points), they will be documented in a case narrative and copies of the Sample Discrepancy Reports (SDRs) or Corrective Action Reports (CARs) must be included in the data packages.

EDD Specification

Laboratory data will be received electronically as an electronic data deliverable (EDD). The data will be delivered as either a flat ASCII file with tab delimiters, a flat ASCII file with fixed width columns, or a Microsoft Excel file. The ASCII or Excel file must have columns present in the order shown in the EDD Specification Table in Appendix A. Character data must not exceed the record sizes indicated and all field names in bold must contain correct information. Non-bold field names may have empty content. The details for the EDD are presented in Appendix A.

Analytical Data Report

The laboratory will report all analytical results using full Contract Laboratory Program (CLP)-type documentation reports to satisfy data validation requirements. Data will be reported by sample delivery group (SDG) or chain-of-custody number (i.e., in the same batches as received at the laboratory). The data report will be delivered both in paper copy and as PDF files on a compact disk (CD-R).

Data Checklists

Two checklists will be used as an aid to consistently review data reports. The hard copy laboratory reports will be reviewed using the check items in the *Data Review Checklist* that is in Appendix A. The hard copy data validation reports will be reviewed using the check items in the *Data Validation Report Checklist* that is in Appendix A.

MS Access Central Database

A consistent methodology to store and integrate related environmental information is critical for a successful site characterization/remediation. Client/server architecture is a proven means to store data in a centralized database location and to establish data "links" on a common field (e.g., location identifiers) through relational database technology. Centralized data storage with

distributed access ensures, whenever possible, data integrity and provides a common source for all appropriate data analysis, reduction, and concise reporting.

The technical data management model for the project consists of a Central Database (Microsoft Access files) that is the repository for environmental sample and analytical data collected as part of the facility remediation process. Other interim database(s) may be used to manage related information. Where appropriate, Data Marts will be used to facilitate timely extraction and publication of consolidated "results" data. This information can be used for analysis, and reporting on remedial investigation and remedial design projects.

2.4 GRAPHICAL DATA

Data integration, manipulation, analysis, and visualization will be achieved through the use of multiple graphical data software packages. These software packages may include the following, as appropriate: Autocad, Surfer, earthVision, and Arcview. Autocad will be the primary software package used for developing the engineering design reports.

2.5 HISTORICAL DATA

Some historical data may need to be entered into the central database. This will occur as data are needed, and typical sources will be laboratory reports, investigation reports, and electronic files. Any necessary historical data will be assessed for data quality and an audit trail will be maintained with respect to the original source of these data.

2.6 DOCUMENT MANAGEMENT

Storage and Backup

Electronic project data will be stored on a secure system within the WESTON file servers. A secure system is defined as a computer system on which reasonable precautions, such as password required access, have been implemented to control access to the project data. WESTON servers are maintained on a network and conform to WESTON corporate procedures for daily, weekly, and monthly backups. After the completion of the project, a backup of the final data will be retained.

Reasonable precautions will be taken to provide electronic files that are free of computer viruses. Reasonable precautions include using commercial anti-virus software and current virus definitions. Virus definitions are updated on the same day that they are available from the vendor.

3. DATA PROCEDURES

3.1 PROJECT DATA FLOW

Each data type collected and managed for the project will follow the basic data life-cycle process. The data life cycle begins with technical data requirements, followed by project planning, data collection and loading, data management, and data presentation. During the project planning phase, the intended purpose for the data, including the identification of performance specifications for the data type, is defined. After appropriate communication of requirements to data collection teams and laboratories, actual sampling occurs in the data collection and loading phases and the data life cycle begins. Captured data are evaluated against pre-established performance specifications to determine the value or relevance to the original objectives. Data are retained for integration and storage in the Central Databases during the integration phase. Following data collection, users can access the Central Database(s) or Data Mart(s) to acquire results and conduct data reduction/analyses. Resulting data can be represented in tables and on maps during the presentation phase. A detailed discussion of each of these project phases is presented in the following subsections.

3.2 FIELD DATA ENTRY

Field Data

Observations and measurements made in the field are recorded in the field logbook. Upon completion of the field investigation, the data will be tabulated for analyses and presentation in the report. Copies of the original data records will be appended to the report as appropriate. Presentation copies summarizing the boring logs and monitoring well installations will also be included in the report.

Data Collection and Loading

The raw data received from the field and analytical laboratory can be voluminous and unorganized. It is imperative that standards and protocols in the area of data collection are established to facilitate data organization and user access to the data. WESTON uses a technical

data management systems model that embodies the following major components addressing data capture:

- Standardized data collection requirements to ensure the efficient and comprehensive capture of all relevant data.
- Standardized transfer and evaluation protocols to avoid the introduction of transcription errors, to verify and validate information against performance requirements, and to establish data of known quality prior to storage.

Data collection occurs on standardized field data collection forms (see *Sampling and Analysis Plan, Consent Order Plans and Reports Volume 2*). Form-based data, including chain-of-custody information, are transmitted or captured directly by the Data Management Team, which is responsible for committing the information to the appropriate sample tracking database. Data passed from the field are integrated with other consultant/contractor-supplied data (e.g., historical data or results from the analytical laboratories) after the data pass through a verification process. This data verification step occurs prior to the commitment of results to the Central Database(s).

There may be some communication and reconciliation activities with the laboratories or other data providers to ensure that the desired data quality levels have been attained. After qualified results are committed to the Central Database(s), they are available for access by all authorized users.

3.3 DATA PROCESSING

3.3.1 EDD (Electronic Data Deliverable)

The laboratory will deliver data in the format as described in Appendix A. The processing steps of the EDD are as follows, as appropriate:

- Receive EDD via Email attachment, Internet upload, or compact disk from the laboratory.
- Import the EDD into a temporary or working Microsoft Access database.
- Run general summary queries to check sample information (e.g., sample IDs, collection dates) and method information.

- Review the COC and the laboratory data report and determine EDD (and sometimes laboratory report) data corrective actions.
- Communicate data errors to the laboratory project manager and receive a corrected EDD and/or laboratory report. If corrections are minor, WESTON data management personnel will implement corrections.
- Commit the EDD data to the Central Database.

3.4 DATA (EDD) VERIFICATION

The EDD must pass a number of data checks before being committed to the Central Database. Analytical data completeness and integrity are examined so that the final data set is of known quality. Verification items include the following, as appropriate:

- Analyte names and Chemical Abstract Service (CAS) numbers in the EDD are verified against the central database chemical look-up table.
- The EDD methods are compared to the COC.
- Data that must match valid values, such as laboratory qualifiers, are checked.
- Data types, such as numeric fields containing numeric results only and not letters or characters, are checked.
- If laboratory QC data are required, the method QC are examined for associated laboratory QC.
- The units in the EDD are compared to the analyte file to ensure consistency in reporting units.
- For each method in the EDD, the analytes are compared to the required analyte lists in the QAPP.
- Field sample identification codes, collection dates, and method names are checked for accuracy against the COC.
- The sample reporting levels are compared to the QAPP reporting levels.
- Re-analyses and dilutions, if they were necessary, are searched for.

3.5 DATA VALIDATION

Data validation will be performed on all data, as appropriate. The resulting data validation qualifiers will be provided electronically by the Data Validator to WESTON and incorporated into the central database to produce a final data set.

3.6 DATA DELIVERY

Data and reports will be delivered in paper and electronic format on compact disks (CDs), e-mail, and/or the Internet, as appropriate. One vehicle that WESTON uses for delivery of data is a project TeamLink^{SM} site. TeamLink is a secure, collaborative web service used for exchanging and managing project information. Progress reports, summary tables, data tables, photographs, and maps can be uploaded to TeamLink and designated personnel can be given access to the secure web site and be automatically notified via e-mail when new data are available.

4. DATA MANAGEMENT TEAM

4.1 ROLES AND RESPONSIBILITIES

Within the overall project organization, the data management team will address information management requirements. Oversight of the data management team is the responsibility of the WESTON Technical Consultant Leader. System Management is responsible for TeamLink, which is the main communication and delivery vehicle for the project. Data Operations covers sample analysis and tracking, laboratory oversight, data entry, data verification, data validation, and data reporting.

4.2 SYSTEM MANAGEMENT

System Management will be responsible for communications protocols and infrastructure requirements for collaboration activities among authorized project team members, internal and external to WESTON. WESTON TeamLink personnel will manage the integrity and performance of the infrastructure configuration against established expectations. They will establish user accounts, passwords, and database access privileges. The WESTON Technical Consultant Leader will be the owner of the TeamLink site and will manage access rights to the project data and TeamLink site as directed by the Wyeth Project Manager.

4.3 DATA OPERATIONS

Data Operations is staffed by computer and scientific professionals (e.g., chemists, geotechnical scientists) who are responsible for supporting and maintaining the databases and data reports. The group manages the database, data entry, data flow, and data reporting. Data Operations personnel will include the following:

Data Management Coordinator—Monitors the general laboratory performance, sample turnaround time, sample analysis and tracking, and QC problems reported by the laboratory. The Data Management Coordinator provides technical expertise in integrating data management procedures and software solutions, and is ultimately responsible for data quality and deliverables.

If a laboratory's performance is determined to be unacceptable, the Data Management Coordinator will implement corrective action.

Data Entry Coordinator—Responsible for entry of legacy and new data into the Central Database. Data entry will be done by experienced technical data entry specialists familiar with analytical and geologic data.

Data Evaluation Coordinator—Oversees the electronic and manual verification and validation of the field and analytical data. Data evaluators are responsible for verifying data as complete, within known ranges, and having fulfilled the requested laboratory analyses.

Data Validator—Follows EPA Validation Guidelines in assessing the quality of the data and applies validation qualifiers for data that do not meet criteria.

Data Reporting Coordinator—Creates new reports and runs existing standard reports on behalf of the project and client managers.

5. REFERENCES

U.S. EPA, Office of Solid Waste, Office of Waste Programs Enforcement.1994. *RCRA Corrective Action Plan.* OSWER Dir. 9902.3-2A.

APPENDIX A

Electronic Data Deliverable (EOD) Specification Table

Data Review Checklist

Data Validation Report Checklist

EDD Specification Table

Field Name[1]	Data Type	Record Size[2]	Description	Table[3]
SiteName	Text	50	Site Name	Sites
StationName	Text	25	Station identifier or name or Location ID	Stations
SampleDate_D	Date/Time	8	Date sample was taken	Samples
SampleMatrix	Text	15	Sample matrix	Samples
SampleTop	Number(Sg)	10	Sample top	Samples
SampleBottom	Number(Sg)	10	Sample Bottom	Samples
DepthUnits	Text	15	Units for sample top and sample bottom	Samples
DuplicateSample	Number(Int)	10	Duplicate samples[4]	Samples
FieldSampleID	Text	20	Client assigned field sample ID	Samples
LabSampleID	Text	20	Lab sample ID	Samples
AltSampleID	Text	20	Alternate sample identification	Samples
CoolerID	Text	20	Cooler ID number - for QA/QC	Samples
Sampler	Text	50	Name of person taking sample	Samples
Description	Text	50	Sample description	Samples
COCNumber	Text	20	Chain-of-custody number	Samples
DeliveryGroup	Text	10	Sample delivery group	Samples
FilteredSample	Text	20	Filter size	Samples
QCSequenceID	Text	15	QC sequence identifier	Samples
QCSampleCode	Text	4	QC code for this sample	Samples
TaskNumber	Text	20	Task number under which sampling is done	Samples
PrimarySample	Text	20	Primary sample to which QC sample is tied	Samples
SampleResult	Text	98	Result of attempted sampling	Samples
ParameterName	Text	60	Name of material analyzed for	Analyses
CASNumber	Text	20	CAS number of material analyzed for	Analyses
AltParamNumber	Text	20	Alternative number for parameter	Analyses
Superseded	Number(Int)	10	Analysis superseded by re-analysis? [5]	Analyses
AnalyticMethod	Text	25	Method for performing analysis	Analyses
Value	Number(Sg)	10	Value measured during analysis	Analyses
ReportingUnits	Text	15	Units of the analysis	Analyses
FlagCode	Text	4	Data qualifier	Analyses
ProblemCode	Text	4	Problems encountered during analysis	Analyses
ValidationCode	Text	4	Code from data validation	Analyses
DetectedResult	Text	1	Was analyte detected?	Analyses
Detect	Number(Sg)	10	Detection limit	Analyses
LimitType	Text	4	Detection limit type	Analyses
Detect2	Number(Sg)	10	2nd detection limit	Analyses
LimitType2	Text	4	2nd detection limit type	Analyses
Error	Number(Sg)	10	Error range for this analysis	Analyses
DilutionFactor	Number(Sg)	10	Dilution factor	Analyses
Basis	Text	1	Reported wet or dry?	Analyses
FilteredAnalysis	Text	20	Filter/measure basis at analytical level	Analyses
LeachMethod	Text	20	Leaching method	Analyses
PrepMethod	Text	20	Lab preparation method	Analyses
ReportableResult	Text	1	Designates analysis as reportable result	Analyses
AnalDate_D	Date/Time	8	Date the analysis was performed	Analyses
ExtractDate_D	Date/Time	8	Date the extraction was performed	Analyses
LabReportDate_D	Date/Time	8	Lab analysis reporting date	Analyses
Lab	Text	10	Name of lab conducting analysis	Analyses
LabComments	Text	50	Lab comments about this analysis	Analyses
AnalysisLabID	Text	20	Lab identification number for analysis	Analyses
AnalyticalBatch	Text	40	Lab batch ID number	Analyses
ValueCode	Text	6	Differentiates between different results	Analyses
RunCode	Text	5	Run code for GC analyses	Analyses
QCAnalysisCode	Text	4	QC code for this analysis	Analyses

[1] Field names in **bold** are the minimally required fields. The others may be blank.
[2] Character width for text fields (and for date and number fields in a fixed width EDD).
[3] Weston database table to receive data, either directly or after converting using a lookup table.
[4] Numbered values for duplicate samples, with 0 for preferred sample, increasing by one for each additional value. Must fill in all duplicates or none.
[5] Numbered values for superseded analyses, with 0 for current analysis, increasing by one for each older value.

EDD Specification Table

File Format – Laboratory data will be received electronically as an electronic data deliverable (EDD). The data will be delivered as either a flat ASCII file with tab delimiters, a flat ASCII file with fixed width columns, or a MicroSoft Excel file. The ASCII or Excel file must have columns present in the order shown in Appendix A. Character data must not exceed the record sizes indicated and all field names in bold are the minimally required fields. Non-bold field names may be blank.

Field Name Description

SampleDate_D – The date on which the sample was taken. Required.

SampleMatrix – The material that the sample is primarily composed of. Provide the full Sample Matrix name, such as "Water". Required.

SampleTop and *SampleBottom* – Soil sample depths or elevations, as instructed by the client. The fields should contain only numeric values. If these fields are not applicable (i.e. water samples) or are unknown to the laboratory, then they should be populated with zeros, for compatibility with ODBC databases. Optional.

DepthUnits – Units for sample top and sample bottom. This is a coded field that is linked to the ReportingUnits lookup table. If this information is unavailable to the lab, "Unknown" should be reported. These units can be entered into the import file by a Data Administrator. Optional.

DuplicateSample – This field should be a zero unless this is a duplicate sample. All analyses must have an entry for this field, with multiple QC samples entered as values incremented from one. Required.

FieldSampleID – The client-assigned field sample ID name for each sample. Required.

LabSampleID – The sample identification number used internally by the laboratory. Required.

AltSampleID – Another sample identification number if needed. Optional.

CoolerID – Number to identify cooler in which primary samples and QC samples were shipped. Optional.

Sampler – Person taking the sample. Optional.

Description – Description of the sample, such as its condition. Optional.

COCNumber – Chain-of-Custody tracking number. Optional.

DeliveryGroup – Sample delivery group. This field is provided for use as a lab tracking field. It could be used to define a group of parameters. Optional.

FilteredSample – Filter information at the sample level. Was the sample filtered, and if so, what size filter was used? It could also be used to identify whether the filtering occurred in the field or the lab. Entries are compared to the Filtered look-up table in the database. The lab can supply either the code or the Filter description, whichever is most consistent with their system (i.e. TOT vs. total), but must coordinate this with the client. Required.

QCSequenceID – QC sequence identifier. This field is another lab tracking field, used to relate field samples to lab samples. Optional.

QCSampleCode – Code to identify QC samples. It ties to the **QCCodes** table, which contains codes for both the sample and analysis levels. The lab should supply the code if available, e.g. DUP for duplicate sample, or O for original sample. If this information is not available to the lab, enter "z" for Unknown. Required.

TaskNumber – The administrative task number under which sampling is done. Optional.

PrimarySample – Stores the Field Sample ID of the primary sample to which the QC sample is tied. This field is blank for original samples, may be blank for field QC samples that have been submitted blind to the lab. This number can be entered into the temporary import table by a Data Administrator. The import routine converts this to the sample number of the primary sample before storing it in the database. Optional.

SampleResult – The result of the sampling process, such as "successful", "dry", "no access". Its primary use is to indicate that obtaining a sample was attempted unsuccessfully. If not available from the lab, this field can be entered into the temporary import table by a Data Administrator. Optional.

If a sample was attempted unsuccessfully, the sample fields should be filled in, however all fields associated with analyses, including parameter name, CASNumber and AltParamNumber, should be left blank. The system will then only attempt to import the sample information.

ParameterName, CASNumber, AltParamNumber – Various combinations of these fields are used to identify the Parameter Name. ParameterName and CASNumber are required. The system compares the ParameterName to the entries in the Parameters and ParameterAlias lookup tables. AltParamNumber is not required, but should be provided if possible to help ensure the correct parameter name assignment. If the ParameterName does not match a lookup entry, the system compares either the CASNumber, or the AltParamNumber (frequently used for Storet codes), to Parameter table entries. Care should be taken that consistent numbers be provided. If ParameterName is left blank, but a CASNumber or AltParamNumber is provided, the system assigns a parameter name from the lookup tables based on a number match. Using only numbers to designate the parameter is not recommended, since the program does not request confirmation of the parameter name that is assigned.

Superseded – This field should be a zero unless the analysis is superseded by a later value in the same file, in which case the entry should be one. This field is used in conjunction with the ValueCode field, discussed later in this section. All analyses should have an entry. Required.

AnalyticMethod – Method used to perform the analysis. Required.

Value – Measured result of the analysis. For laboratory control spike and matrix spike samples, the results should be reported in percent recovery, with the units in %. Moisture content should

be reported as a separate analytical record, with the units in %. They should be entered on a "by weight" basis, based on total weight. Required.

ReportingUnits – Units of the analysis. The entry provided should be the full abbreviation, such as "mg/l". Entries must match an entry in the ReportingUnits lookup table in the database. Detection limits and radiologic error must be reported in the same units as the value. Required.

FlagCode – One to four coded entries for the analytical flag describing the analysis. Each character in the field must match an entry in the AnalyticFlags lookup table in the database. More than one flag can be entered. For example, if "b" (detected in blank) and "j" (estimated value) are both entered in the lookup table, then "bj" can be entered as an analytic flag (estimated value, detected in blank). If the analysis is considered a usable value, and would not otherwise have a flag, this field should contain the code for Detected Value (usually a "v"). If the flag is unknown, the field should contain a "z". Required.

ProblemCode – Analytic problems are usually described in the narrative, and not included in the electronic format. If this field data is not provided, the field should contain a "z" for unknown. If the laboratory chooses to supply problems in the electronic file, then the codes must match entries in the AnalyticProblems table. As with the FlagCode field, the entry can consist of from one to four approved codes. Required.

ValidationCode – One to four flags associated with validation of analyses. The data validation organization usually provides this field, which can contain from one to four of these codes. Others should place a "z" for Unknown in this field. Required.

DetectedResult – Supplied by the lab, this field should contain either "y" for yes, the analyte was detected, or "n" for no, the analyte was not detected. This field overlaps slightly with FlagCode. The purpose of this field is to separate the non-detect flag from other lab qualifiers, such as "j" or "b", for statistical, evaluation and validation purposes. Optional.

Detect – Detection limit for the analysis. Detection limits must be reported in the same units as the value. Required.

LimitType – Type of limit contained in the Detect field, such as "MDL", "PQL", "RL", etc. Required.

Detect2 – A second detection limit. Standards should be set for which type of limit should be entered in each field for a given site, for example: IDL or MDL in the first column, CRDL or PQL in the second. Optional.

LimitType2 – Limit type for second detection limit. Optional.

Error – Standard error for radioactivity measurements. Required for radiochemical measurements.

DilutionFactor – Amount that the sample was diluted prior to analysis. Required.

Basis – Reported wet or dry. Should be "w" for wet or "d" for dry. Can also report "n" for not applicable, or "z" for unknown. Required.

FilteredAnalysis –Filter or measure basis information at the analysis level. Entries are compared to the Filtered look-up table in the database. As with the FilteredSample field, the lab can supply either the code or the description for this field. Required.

LeachMethod – Method used to leach sample. Entries are compared to the Leach Method lookup table to maintain consistency. The lab should supply the full name of the method, e.g., TCLP. If the analysis was not leached, "None" should be reported. Required.

PrepMethod – Method used to prepare sample separate from leaching. Optional.

ReportableResults – Flag for whether the result is to be used in reports. Report "Y" for yes, or "N" for no. Reported by labs or selected by Project Managers for multiple analyses from a selected sample, such as analyses at multiple dilutions. Optional.

AnalDate_D – Date on which the analysis was performed. Optional.

ExtractDate_D – Date on which the material was extracted for analysis. Optional.

LabReportDate_D – Date on which the lab reported the analysis. Optional.

Lab – Name of the laboratory performing the analysis. Required.

LabComments – Lab comments about this analysis. Optional.

AnalysisLabID – Lab identification number at the analysis level. LabSampleID tracks lab analyses at the sample level. This field is for identification numbers at the analysis level. Optional.

AnalyticalBatch – Lab batch identification number. Required.

ValueCode – Parameter value classification. This field identifies the analytical trial, and supplies the reason for a superseded analysis. It is a coded entry enforced by a lookup table. The lab should report the code, such as "RE" for re-extracted, "DL" for dilution, etc., or "O" for original analysis. Required.

RunCode – Confirmation run identification. This is a coded entry enforced by a lookup table. The lab should supply the code, such as "PR" for primary run, "n" for not applicable, or "z" for Unknown. Required.

QCAnalysisCode – QC code at the analysis level. It ties to the **QCCodes** table, which contains codes for both the sample and analysis levels. The lab should supply the code for this field, such as "TIC" for tentatively identified compound, or "O" for original analysis. Required.

Data Review Checklist

Area Name: _____ Last Collection Date: _____
Lab Batch ID: _____ Due Date (30 days after last collection): _____
Samples: _____ 1st Lab Report Received Date: _____
Sample Matrix: _____ Last Lab Report Received Date: _____
Reviewer: _____ EDD Received Date: _____
Review Date: _____

Group:	Organic										ADP					Inorganic											Other	
Methods:	**Voc** (8260)	**Svoc** (8270)	**Pest** (8081)	**Pcb** (8082)	**Explosives** (CHPPM)	**Carbamate** (531.1)	**Chlorinated Herb** (515.1)	**Herbicide** (525.2)	**EDB** (504.1)	**Glyphosate** (547)	**OrganoSulfur** (AAA8)	**ThioDiGlycol** (UL09)	**DIMP/DMMP** (Phosphonate)	**IMPA/MPA** (Phosphonic Acid)	**CAA/FAA** (Chloro&FluoroAcetic Acid)	**Metal-Soluble** (6000s/7000s)	**Metal-Total** (6000s/7000s)	**Total Cyanide** (9012A)	**Alkalinity** (310.1)	**Total Phosphorus** (365.3)	**Total Phenolics** (420.1)	**Perchlorate** (314.0)	**TOC** (415.1, 9060)	**Gross Alpha/Beta, Gamma Spec**	**ButylTin** (OR560)				
Method Marked on CoC?																												

Item	Status			Comment
	Yes	No	N/A	
Chain of Custody (CoC) Present and Legible?				
Lab's CoC Copy Attached to this Check List?				
Labs' Reported IDs Match CoC Sample IDs?				
Labs' Reported Collection Dates Match CoC Collection Dates?				
All Data Reported for each Samples' Methods?				
Narrative Present?				
Narrative describes all data as Meeting QC Criteria?				
Lab Qualifiers/Flags are Defined (e.g., Glossary of Lab Flag Codes?)				
Method Blanks Clean?				
Field/Trip Blanks Clean?				
Diss Metals < Their Assocd Total Metals' Results?				
Diss Metals <150% of their assocd Total Metals' Results(i.e., <3:2 Ratio)?				
Data Received on or before the Due Date?				

Other Comments or Corrective Actions:

Data Validation (DV) Report Checklist

Area Name: _____
Lab Batch ID: _____
Sample Matrix: _____
Reviewer: _____
Review Date: _____

Regular Samples: _____
Trip Blank (TB) Samples: _____
Rinse Blank (RB) Samples: _____
DV Report Received Date: _____

Group:	Organic										ADP					Inorganic										Other	
Methods:	**Voc** (8260)	**Svoc** (8270)	**Pest** (8081)	**Pcb** (8082)	**Explosives** (CHPPM)	**Carbamate** (531.1)	**Chlorinated Herb** (515.1)	**Herbicide** (525.2)	**EDB** (504.1)	**Glyphosate** (547)	**OrganoSulfur** (AAA8)	**ThioDiGlycol** (UL09)	**DIMP/DMMP** (Phosphonate)	**IMPA/MPA** (Phosphonic Acid)	**CAA/FAA** (Chloro&FluoroAcetic Acid)	**Metal-Soluble** (6000s/7000s)	**Metal-Total** (6000s/7000s)	**Total Cyanide** (9012A)	**Alkalinity** (310.1)	**Total Phosphorus** (365.3)	**Total Phenolics** (420.1)	**Perchlorate** (314.0)	**TOC** (415.1, 9060)	**Gross Alpha/Beta, Gamma Spec**	**Buty/Tin** (OR560)		
Form I Data in DV Report?																											

Item	Status			Comment
	Yes	No	N/A	
Sample and Method Summary Present?				
Methodology References (Organic) Present?				
Methodology References (Inorganic) Present?				
Data Reports Present for All Method Reference Methods?				
Data Reports Present For Each Sample per Method?				
Narrative Present?				
QC Parameters (sect 1-12 or 13) All "No Qualifiers Applied"?				
Data Validation Qualifier Code Glossary Present?				
Chain of Custody (CoC) Present?				

Other Comments or Corrective Actions:

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
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9 October 2002

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 1

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached 2 copies of the Consent Order Plans and Reports, Volume 1. The plans provided in Volume 1 include:

- Project Management Plan
- Community Relations Plan
- Data Management Plan
- Institutional Control Plan

The submission of Volume 1 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b. The remaining reports will be submitted to the U.S. EPA in subsequent volumes.

If you have any questions or comments regarding Volume 1, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas Cornuet

Thomas S. Cornuet
Project Manager

Attachment
cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON

Institutional Control Plan
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

October 2002

Prepared for

WYETH
Florham Park, New Jersey

Prepared by

Weston Solutions, Inc.
1400 Weston Way
West Chester, Pennsylvania 19380

W.O. No. 02994.002.009

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LIST OF ACRONYMS

AHP	American Home Products Corporation
CMI	Corrective Measures Investigation
CMS	Corrective Measures Study
DCE	Dichloroethene
GAC	Granular Activated Carbon
ICP	Institutional Control Plan
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SVE	Soil Vapor Extraction
TCA	Trichloroethane
TCE	Trichloroethene
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WKI	World Kitchen, Incorporated

1. INTRODUCTION

1.1 PLAN OBJECTIVES

The Institutional Control Plan (ICP) for the Massillon, Ohio, World Kitchen, Inc. (WKI) plant (U.S. EPA ID No. OHD 045-205-424) has been prepared to fulfill reporting requirements set forth in Section VI, Paragraph 15, Section IX, Paragraph 39b, and Section 2 and Table 1 of Attachment 2 of the Administrative Order on Consent (Consent Order) between the United States Environmental Protection Agency (U.S. EPA), WKI, and Wyeth (2002).

The purpose of this ICP is to document the institutional controls, and the facility access and reporting requirements mandated by U.S. EPA Region V for the WKI facility. This ICP was developed in accordance with U.S. EPA Region V guidance (U.S. EPA, 2000). The plan provides summaries and descriptions of the following:

- Facility ownership
- Facility description
- Facility history.
- Soil and groundwater contaminants left in place.
- The following institutional controls:
  - Construction restrictions
  - Water use restrictions
  - Property use restrictions
- Required due diligence efforts.
- Deed notice recording requirements.

1.2 FACILITY OWNERSHIP

EKCO Housewares, Inc. owned and operated the Massillon, Ohio, facility until 1965, at which time it was acquired by American Home Products Corporation (AHP). AHP continued to operate the facility until 1984 when it was sold to the EKCO Group. In 1999, the EKCO Group sold the facility to WKI, the current owner of the property. AHP changed its name to Wyeth in March 2002.

1.3 FACILITY DESCRIPTION

The facility occupies approximately 13 acres in the City of Massillon, Stark County, Ohio (Figure 1-1). The area surrounding the site is largely urban and industrial. Land use to the northwest is more rural with more open space. The property is triangular in shape and lies approximately 1,500 ft west of the Tuscarawas River. The facility is bordered to the north by Newman Creek, while the Penn Central and the Baltimore and Ohio Railroads border the property to the west and east, respectively. The Baltimore and Ohio Railroad has numerous spurs and sidetracks adjacent to the plant, which are used for the storage of rail cars and track maintenance vehicles.

Manufacturing, warehousing, and shipping activities are conducted within a complex of interconnected buildings, which cover approximately 5.6 acres of the 13-acre site. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas. The building locations are shown on Figure 1-2.

A variety of businesses operate in the immediate vicinity of the plant, including: Ohio Packaging (paper supplier) to the south, sand and gravel quarries to the west and northwest, Carter Lumber (retail) and Price Brothers, Inc. (concrete pipe) to the north, and the Consumer Water Service (public water supply) waterworks and an automobile reclamation site to the east and northeast. An inactive municipal landfill reportedly exists just east of Consumer Water Service. The City of Massillon is believed to have been the principal user of the landfill; however, other users may also have been involved. The landfill was apparently informally operated, that is, no weigh station or access control was believed to have been present, and the landfill was not fenced. It is unclear whether records of ownership, methods of operation, or methods of "closure" have been retained.

1.4 FACILITY HISTORY

The first recorded activities occurred at the facility in approximately 1929, when the property was owned by Standard Oil Company. From approximately 1929 to 1942 Fort Pitt/Massillon Bridge Works manufactured iron and steel bridges and structural iron. In 1945, the Massillon

FIGURE 1-1 SITE LOCATION MAP
WORLD KITCHEN, INC. (EKCO) FACILITY
MASSILLON, OHIO

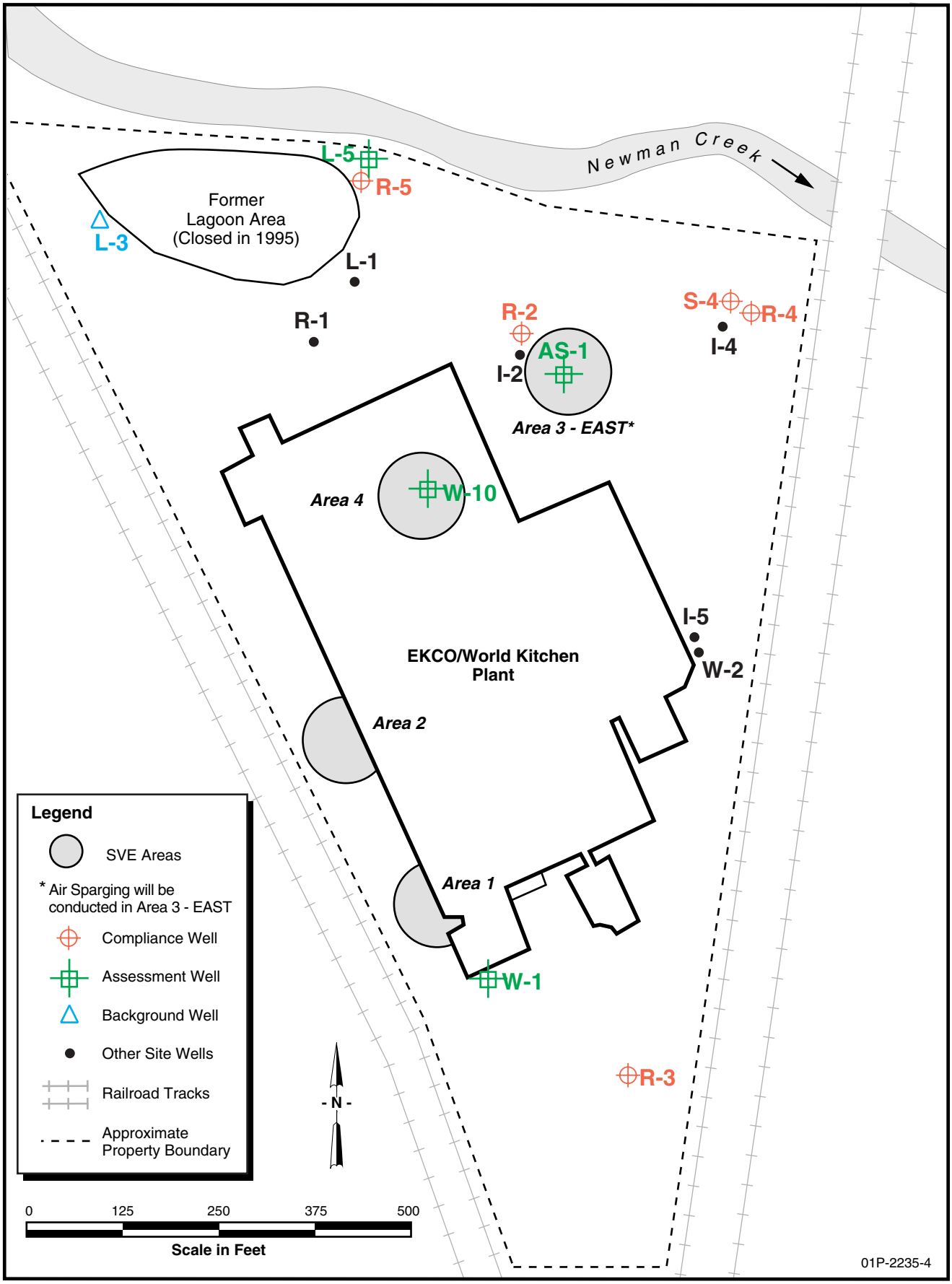

FIGURE 1-2 EKCO – MASSILLON, OHIO PROJECT GROUNDWATER MONITORING PROGRAM WELLS AND SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING AREAS

facility was manufacturing aluminum and stainless steel cookware. By 1951, with the United States' involvement in the Korean Conflict, the plant was manufacturing 90 mm and 105 mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells, W-1 and W-2, at the facility (Figure 1-2). In 1953, a sewer was constructed which carried the plant waste to a discharge point along Newman Creek. At approximately the same time, a surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Wastewaters from manufacturing were discharged to the surface impoundment.

During 1954, the facility began alternate manufacturing operations. The primary function of these operations was returned to manufacturing cookware at the facility. Solvents (primarily trichloroethene [TCE] or 1,1,1-trichloroethane [1,1,1-TCA]) were used to clean the products prior to continuing production. These solvents were used for cleaning purposes until 1994. In 1994, the solvents were replaced with a Borax aqueous cleaner which is still used at the facility. No chlorinated solvents have been used at the facility since 1994.

By 1967, trends in the cookware manufacturing industry had changed, resulting in the installation of porcelain- and Teflon-coating units. In 1969, with the development of new NPDES regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to accept waste products associated with plant activities. These waste products have included:

- Deionizers from plant operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain-Teflon-coated aluminum cookware (aluminum frit, various coloring inorganics oxides, lead, cadmium, selenium, cobalt).
- Alkaline washer fluids to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued for the facility. As the 1970's progressed, the facility discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper-coating operations had ended and the principal products manufactured at the facility became pressed and coated non-stick bakeware.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the Corrective Measures Study (CMS). This correction is based on more recent review of historical plant documents.

The surface impoundment was reactivated in 1980 under the existing NPDES permit, and received housing degreaser filter water until mid-1984. The surface impoundment was finally decommissioned in December 1985. In March 1984, when the plant applied for a renewal of their NPDES permit, analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at the facility. The waste stream was diverted from the surface impoundment to discharge in Newman Creek in December 1985. At that time, the surface impoundment (lagoon) was permanently taken out of service.

In 1992, the facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area. During 1993 and 1994, Roy F. Weston, Inc. (WESTON®) was retained by AHP to pursue a clean closure for the lagoon. Closure activities were conducted at the site from August 1993 to June 1994. A closure certification report was submitted to the OEPA in July 1994, and approval of the lagoon closure was issued in January 1995. Now that the lagoon is officially closed, quarterly groundwater sampling of the lagoon wells is no longer required for the RCRA lagoon closure.

WKI (formerly EKCO) continues to manufacture pressed and coated non-stick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface. A detailed description of the historical environmental investigations and a table summarizing the facility history are provided in the Community Relations Plan (Consent Order Reports and Plans, Vol. 1).

2. CONTAMINANTS OF CONCERN

2.1 SOIL CONTAMINATION

The most recent soil sampling program was performed at the facility on 20 through 22 September 2000. Since the previous soil sampling program was completed 9 years earlier, it was anticipated that the concentrations of target VOCs at the site might have decreased due to natural attenuation. Therefore, it was decided that additional subsurface soil sampling was necessary to both confirm and delineate the extent of target VOCs in the proposed remediation areas at the site (Figure 2-1). The target VOCs at the EKCO site include TCE, 1,2-DCE, 1,1-DCE, and 1,1,1-TCA.

Soil borings were completed at 19 locations across the site (Figure 2-1). The soil boring locations were selected on the basis of results obtained from previous borings drilled in 1988 and 1991, and also on requests made by the U.S. EPA.

The soil analytical results were compared with the U.S. EPA Region V residential and industrial soil preliminary remediation goals (PRGs):

Contaminant	Industrial PRG (µg/kg)	Residential PRG (µg/kg
TCE	6,100	2,800
1,2-DCE	150,000	43,000
1,1-DCE	120	54
1,1,1-TCA	1,400,000	630,000

The highest detected levels were found under the northwest portion of the facility beneath the building foundation. Cis-1,2-DCE and 1,1,1-TCA concentrations did not exceed their respective PRGs at any of the soil sample locations, while concentrations of 1,1-DCE in excess of its PRG were detected at four locations, with the highest levels again found under the northwest portion of the building foundation. The building's concrete floor slab currently prevents human exposure to

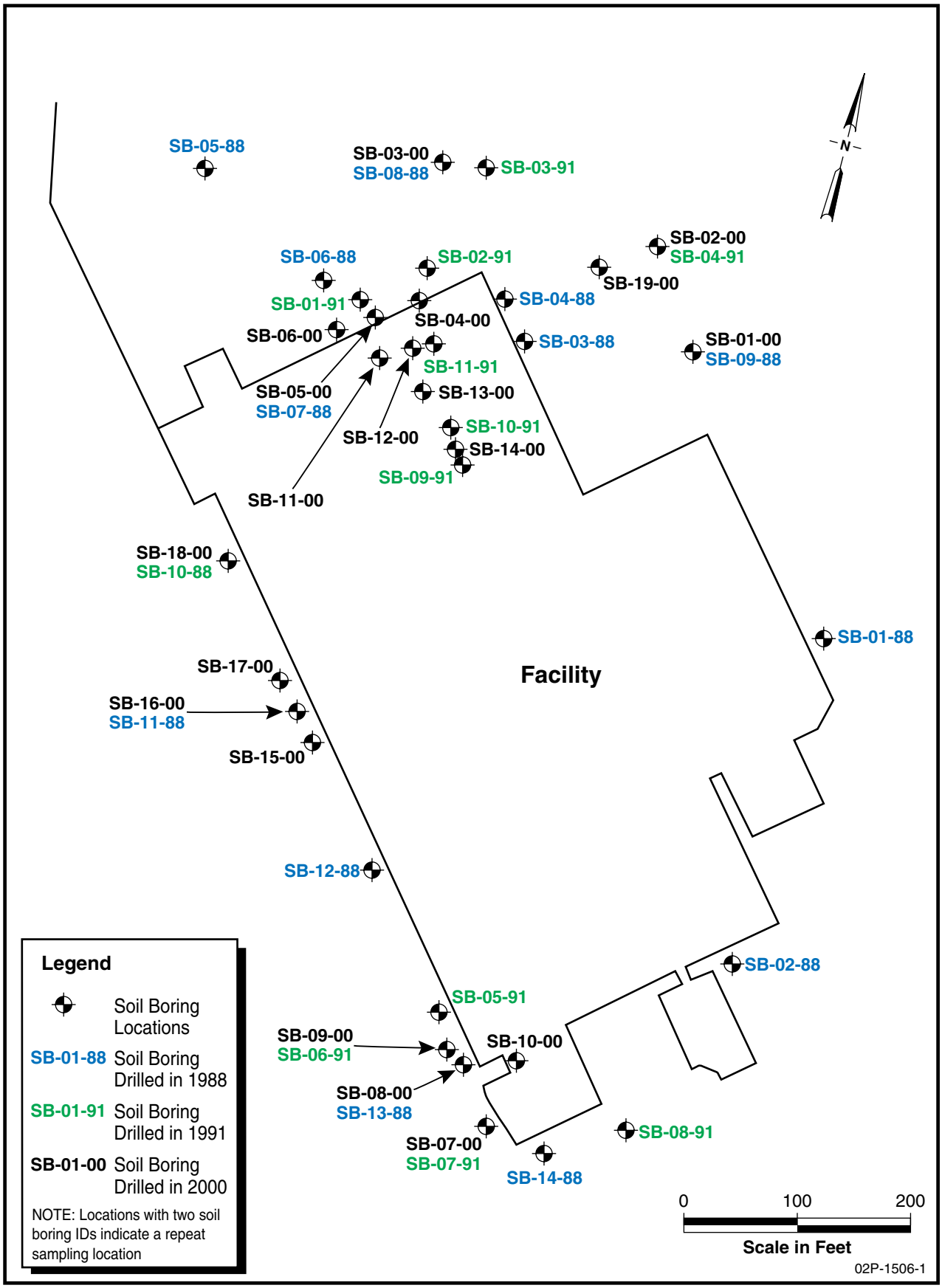

FIGURE 2-1 1988, 1991, AND 2000 SOIL BORING LOCATIONS

any soil contamination located beneath the building. Soil remediation measures have been approved by the EPA and will be initiated in 2002 to treat the VOC-contaminated soil.

2.2 GROUNDWATER CONTAMINATION

Groundwater sampling was conducted at the facility site in December 1988, September 1991, and March 1992. In addition to these three sampling events, selected monitor wells were sampled quarterly from 1989 to 1995 as part of the lagoon closure plan for the site. The monitor well samples have been collected semiannually since 1995, with the most recent sampling event occurring in August 2002. WKI samples site production/recovery wells W-1 and W-10 monthly.

The VOCs detected in groundwater were predominantly TCE, 1,1,1-TCA, and their respective breakdown products, including 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. Maximum Contaminant Levels* (MCLs) for the contaminants are as follows:

TCE	–	0.005 mg/L
1,1-DCE	–	0.007 mg/L
1,2-DCE (cis)	–	0.07 mg/L
1,2-DCE (trans)	–	0.100 mg/L
Vinyl chloride	–	0.002 mg/L
1,1,1-TCA	–	0.2 mg/L

*These MCLs are used for the purpose of this analysis, even though there is no current or reasonably anticipated use of on-site groundwater for drinking purposes.

The results of the recent well sampling show that MCLs were only exceeded for four compounds in the wells sampled: TCE, cis-1,2-DCE, vinyl chloride, and 1,1,1-TCA. A review of the historical data shows that the site contaminants are generally decreasing, with the detected concentrations in the monitor wells either below or approaching their respective MCLs. Groundwater in the water-bearing zones is currently contained on-site and any VOCs that exist in the groundwater at the site are being recovered by site production/recovery wells W-1 and W-10 and are being treated by an on-site air stripper system. The highest contaminant

concentrations at the site were detected in production/recovery wells W-1 and W-10, and results of the September 2002 samples collected from these wells are summarized below:

Contaminant	**W-1 (mg/L)**	**W-10 (mg/L)**
TCE	0.034	0.090
1,1-DCE	<0.005	<0.005
1,2-DCE (cis)	0.013	0.095
1,2-DCE (trans)	<0.005	<0.005
Vinyl chloride	<0.001	<0.001
1,1,1-TCA	0.021	0.280

3. PRESENT AND EXPECTED FUTURE USES

3.1 PRESENT USE

As described in Section 1.3, the facility is currently used to manufacture pressed and coated non-stick bakeware. Consequently, activities at the site are limited to those involved with the manufacturing, warehousing, and shipping of these non-stick bakeware products.

3.2 EXPECTED FUTURE USE

It is expected that the facility will continue to be used for industrial purposes. The facility is currently zoned light industrial, while the zoning of adjacent property is a mixture of light industrial, general industrial and family residential. It is unlikely that the zoning will change to allow commercial/residential development, until contaminated soil at the facility is cleaned up to the residential soil performance standards for human exposure.

4. INSTITUTIONAL CONTROLS

Institutional controls are defined as any mechanism(s) used to restrict inappropriate uses of land, facilities, and environmental media by limiting exposure to residual contaminants left behind as part of a RCRA remedy. They will be used at the facility to supplement the selected active remediation measures. The institutional controls to be implemented at the facility are intended to restrict the facility to non-residential use only.

The institutional controls presented in this plan are mandated by the Consent Order issued by the Administrator of the U.S. EPA to WKI and AHP (Wyeth) under Section 3008(h) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act of 1976 (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. § 6928(h). The Administrator has delegated the authority to issue orders under Section 3008(h) of RCRA to the Chief, Enforcement and Compliance Assurance Branch; Waste, Pesticide and Toxics Division; U.S. EPA Region V.

4.1 DESCRIPTIONS OF INSTITUTIONAL CONTROLS

The institutional controls described in this section are specified in Paragraphs 21 through 23 and Paragraphs 25 and 26 of the Consent Order. The current property owner, WKI, is responsible for implementing these controls which include the following:

1. WKI must not allow water from any existing wells at the facility to be used for drinking, bathing, washing, or other human contact purposes or for livestock, farming or irrigation until the groundwater performance standards specified in Table 4-1 are achieved. WKI must also not allow the installation of any new water wells for drinking, bathing, washing, or other human contact purposes or for livestock, farming or irrigation on this property until the groundwater performance standards specified in Table 4-1 are achieved.

2. WKI must not allow any residential activities at the facility for as long as soils at the facility remain contaminated above the residential soil performance standards for human exposure (Table 4-2). The term "residential activities" shall include, but not be limited to, the following:

    a. Single and multi-family dwelling and rental units.

    b. Day care centers and preschools.

Table 4-1
Groundwater Performance Standards
for the Facility

Groundwater Contaminant	Groundwater Cleanup Level (µg/L)
1,1-Dichloroethane	810
1,1-Dichloroethylene	7
cis-1,2-Dichloroethylene	70
trans-1,2-Dichloroethylene	100
1,1,1-Trichloroethane	200
Trichloroethylene	5
Vinyl chloride	2

Table 4-2
Residential Soil Performance Standards
for Human Exposure to Contaminants at the Facility

Soil Contaminant	Soil Cleanup Level (µg/kg)
1,1-Dichloroethylene	54
1,2-Dichloroethylene (total)	43,000
1,1,1-Trichloroethane	630,000
Trichloroethylene	2,800

c. Hotels and motels.

d. Educational (except as a part of industrial activities at the facility) and religious facilities.

e. Restaurants and other food and beverage services (except as a part of industrial activities at the facility).

f. Entertainment and recreational facilities (except as a part of industrial activities at the facility).

g. Hospitals and other extended care medical facilities (except as a part of industrial activities at the facility).

h. Transient or other residential facilities.

The term "industrial activities" shall include manufacturing, processing operations and office and warehouse use including, but not limited to, production, storage and sales of durable goods and other non-food chain products and parking/driveway use.

3. WKI must restrict activities at the facility that may reasonably result in human exposure to soil at unacceptable risk levels (see industrial soil performance standards for human exposure to contaminants of concern listed in Table 4-3). The point of compliance for restricting activities is any point where direct contact exposure to soil may reasonably occur.

4. WKI must restrict the use of the facility in any manner that may interfere with a remedial action, operation and maintenance, monitoring, or other measures necessary to assure the effectiveness and integrity of the remedy to be implemented pursuant to the Consent Order. Such restrictions include, but are not limited to:

   a. Pumping of groundwater that impacts the effectiveness of the on-site pump-and-treat system in maintaining an inward groundwater gradient from the facility boundary to the two active industrial water wells. WKI must also notify adjacent landowners, and affected state and local governments of the pump-and-treat groundwater remedy at the facility.

   b. WKI must also use due diligence to detect any current and/or future off-site groundwater pumping activities that may (i) impact Wyeth's ability to prevent off-site migration of contaminated groundwater from the facility or (ii) impact the inward groundwater gradient from the facility boundary toward its two pumping industrial water wells and promptly notify U.S. EPA, Wyeth and appropriate state and local governments if it becomes aware of such activities. Due diligence shall include, but is not limited to, a semiannual review of available State and local records pertaining to (i) releases of hazardous substances, pollutants, or contaminants to the environment,

Table 4-3
Industrial Soil Performance Standards
for Human Exposure to Contaminants at the Facility

Soil Contaminant	Soil Cleanup Level (µg/kg)
1,1-Dichloroethylene	120
1,2-Dichloroethylene (total)	150,000
1,1,1-Trichloroethane	1,400,000
Trichloroethylene	6,100

c. and (ii) groundwater well installation permits, construction project dewatering permits, and increases in well pumping rates associated with activities within a 0.50-mile radius of the facility. WKI shall provide Wyeth written notification of the results of its review of these records by January 15 and July 15 of each year during which the Consent Order is in effect, unless U.S. EPA and Wyeth agree to an alternate schedule.

d. The installation, construction, removal, or use of any wells or the excavation of any soil within areas exceeding soil cleanup goals as designated by U.S. EPA in its December 13, 2000 letter to the facility except as approved by U.S. EPA as consistent with the Order.

5. WKI must record with the Office of Recorder, Stark County, Ohio, a deed notice in the chain of title for the facility which, at a minimum, includes the restrictions specified above, and in Paragraphs 21 through 23 and Paragraph 25 of the Consent Order. Within 45 days of the effective date of the Consent Order, WKI must submit the notice to U.S. EPA for review and approval. Within 15 days of U.S. EPA's approval, WKI must record the deed notice. Within 30 days of recording the deed notice, WKI must provide U.S. EPA with a certified copy of the original notice.

4.2 REPORTING AND OTHER REQUIREMENTS

Wyeth and WKI will establish a publicly accessible repository for information regarding site activities and conduct public outreach and involvement activities. The planned public outreach and involvement activities are further described in the Community Relations Plan (Administrative Order on Consent Reports and Plans, Volume 1). The information repository will be located at:

Massillon Public Library
208 Lincoln Way East
Massillon, OH 44646
(330) 832-9831

Institutional control monitoring reports will be submitted to the U.S. EPA with the quarterly progress reports. The institutional control monitoring report will contain at a minimum:

1. A description of how WKI is meeting the facility institutional control requirements.
2. An evaluation of whether all facility institutional control requirements are being met.
3. A description of any deficiencies and the efforts or measures that have been or will be taken to correct problems.

The institutional controls inspection form and the semiannual records review form, Tables 1 and 2, respectively, in Attachment 1 will be used to fulfill the reporting requirements.

4.3 ACCESS

The following site access requirements are specified in Paragraphs 33 and 34 of the Consent Order.

1. Upon reasonable notice, and at reasonable times, U.S. EPA, its contractors, employees, and any designated U.S. EPA representatives may enter and freely move about the facility during the effective dates of the Consent Order for the purpose of reviewing the progress of Wyeth and WKI in implementing the provisions of the Consent Order by, among other things, interviewing facility personnel and contractors; conducting tests, sampling and monitoring as U.S. EPA deems necessary; using a camera, sound recording, or other documentary equipment; and verifying the reports and data Wyeth submits to U.S. EPA. Wyeth and WKI will permit such persons to inspect and copy all non-privileged photographs and documents, including all sampling and monitoring data, that pertain to work undertaken under the Consent Order and that are within the possession or under the control of Wyeth, WKI or their contractors or consultants.

2. Upon request, U.S. EPA will provide Wyeth and WKI split samples of any samples collected by U.S. EPA, or authorized representatives of U.S. EPA, and all copies of all photographs, tapes, video or other recorded evidence created by U.S. EPA and releasable under the Freedom of Information Act, including all analytical results and any technical data and reports collected or prepared by U.S. EPA.

3. To the extent that work being conducted pursuant to the Consent Order must be done beyond the facility's property boundary, Wyeth must use its best efforts to obtain the necessary access agreements from the present owner(s) of such property within 30 days after Wyeth knows of the need for access. Any such access agreement must provide for the access by U.S. EPA and its representatives. Wyeth must submit a copy of any access agreement to U.S. EPA's Project Manager. If it does not obtain agreements for access within 30 days, Wyeth must notify U.S. EPA in writing within 14 additional days of both the efforts undertaken to obtain access and the failure to obtain access agreements. U.S. EPA may, at its discretion, assist Wyeth in obtaining access.

5. REFERENCES

U.S. Environmental Protection Agency, Region 5. Waste, Pesticides, and Toxics Division. March 2000. "Use of Institutional Controls in the RCRA Corrective Action Program."

U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. September 2000. "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups."

ATTACHMENT 1

TABLE 1 – INSTITUTIONAL CONTROLS INSPECTION FORM

TABLE 2 – SEMIANNUAL RECORDS REVIEW FORM

TABLE 1
QUARTERLY INSPECTION REPORT FOR EKCO FACILITY
INSTITUTIONAL CONTROL PLAN

DATE:_____ **INSPECTOR:**_____

Institutional Controls	Status	Comments
1.) Water from existing facility wells not to be used for human contact or agricultural purposes.* (21)		
2.) Water from new facility wells not to be used for human contact or agricultural purposes.* (21)		
3.) Residential activities not allowed at the facility.** (22)		
4.) Activities that expose humans to contaminated soil must be restricted.** (23)		
5.) Activites that interfere with AOC remedy must be restricted. These restrictions include or require the following: (25)		
a.) No pumping of facility groundwater that would impact the pump-and-treat system's effectiveness. (25)		
b.) Notification of adjacent landowners, state and local governments of facility pump-and-treat remedy. (25)		
c.) Due diligence to detect offsite groundwater pumping activities that may impact facility remediation activites. (25)		
d.) Notification of U.S. EPA, Wyeth and appropriate state and local governments if offsite pumping activities are detected. (25)		
e.) Semiannual state and local records review pertaining to: - releases of hazardous substances, pollutants, or contaminants to the environment. (25)		
- groundwater well installation permits construction dewatering permits, and increases in well pumping rates within 0.50 mile radius of facility. (25)		

TABLE 1
QUARTERLY INSPECTION REPORT FOR EKCO FACILITY
INSTITUTIONAL CONTROL PLAN

f.) Provide written notification to Wyeth of record review results by January 15th and July 15th of each year during which AOC is in effect. (25)		
g.) Restriction of installation, construction, removal, or use of any wells or evacuation of any soil within areas exceeding cleanup goals. (25)		
6.) Record with Office of Recorder, Stark County, Ohio, a deed notice in the chain of title for the facility which includes the restrictions specified in paragraphs 21 through 23 and paragraph 25 of AOC.*** (26)		

*Restriction maintained until groundwater performance standards are achieved.
**Restriction maintained until soil performance standards are achieved.
***Deed notice must be submitted to U.S. EPA for review within 45 days of effective date of AOC.
The notice must be recorded within 15 days of U.S. EPA's approval.
(25) - The AOC paragraph in which the use restriction or requirement is specified.

Table 2
Semiannual Review of State and Local Records
Institutional Control Plan for EKCO Facility

Date:_____ Reviewer:_____

Activity	Location	Comments
Releases of hazardous substances, pollutants, or contaminants to the environment.		
Groundwater well installation permits.		
Construction project dewatering permits.		
Offsite well pumping rate increases.		

Note - Results of the semiannual review must be submitted by WKI to Wyeth by January 15th and July 15th of each year during which the AOC is in effect.

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 • Fax 610-701-3186
www.westonsolutions.com

9 October 2002

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 1

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached 2 copies of the Consent Order Plans and Reports, Volume 1. The plans provided in Volume 1 include:

- Project Management Plan
- Community Relations Plan
- Data Management Plan
- Institutional Control Plan

The submission of Volume 1 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b. The remaining reports will be submitted to the U.S. EPA in subsequent volumes.

If you have any questions or comments regarding Volume 1, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas Cornuet

Thomas S. Cornuet
Project Manager

Attachment
cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON

Project Management Plan
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

October 2002

Prepared for

WYETH
Florham Park, New Jersey

Prepared by

Weston Solutions, Inc.
1400 Weston Way
West Chester, Pennsylvania 19380

W.O. No. 02994.002.009

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LIST OF ACRONYMS

AHP	American Home Products Corporation
CMI	Corrective Measures Investigation
CMS	Corrective Measures Study
DCE	Dichloroethene
GAC	Granular Activated Carbon
ICP	Institutional Control Plan
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SVE	Soil Vapor Extraction
TCA	Trichloroethane
TCE	Trichloroethene
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WKI	World Kitchen, Incorporated

1. INTRODUCTION

1.1 PLAN OBJECTIVES

The Project Management Plan for the Massillon, Ohio, World Kitchen, Inc. (WKI) plant (U.S. EPA ID No. OHD 045-205-424) has been prepared to fulfill reporting requirements set forth in Section VI, Paragraph 15, Section IX, Paragraph 39b, and Section 2 and Table 1 of Attachment 2 of the Administrative Order on Consent between the United States Environmental Protection Agency (U.S. EPA), WKI, and Wyeth (2002). This plan is based on guidance provided in the RCRA Corrective Action Plan (U.S. EPA, 1994). The purpose of this plan is to provide a summary of the following:

- Facility Ownership
- Facility Description
- Facility History
- Project Management Approach
- Key Project Personnel, Contact Information, and Qualifications
- Remediation Objectives
- Project Schedule
- Estimated Project Budget
- Project Closeout Procedures

1.2 FACILITY OWNERSHIP

EKCO Housewares, Inc. owned and operated the Massillon, Ohio, facility until 1965, at which time it was acquired by American Home Products Corporation (AHP). AHP continued to operate the facility until 1984 when it was sold to the EKCO Group. In 1999, the EKCO Group sold the facility to WKI, the current owner of the property. AHP changed its name to Wyeth in March 2002.

1.3 FACILITY DESCRIPTION

The facility occupies approximately 13 acres in the City of Massillon, Stark County, Ohio (Figure 1-1). The area surrounding the site is largely urban and industrial. Land use to the northwest is more rural with more open space. The property is triangular in shape and lies approximately 1,500 ft west of the Tuscarawas River. The facility is bordered to the north by

FIGURE 1-1 SITE LOCATION MAP
WORLD KITCHEN, INC. (EKCO) FACILITY
MASSILLON, OHIO

Newman Creek, while the Penn Central and the Baltimore and Ohio Railroads border the property to the west and east, respectively. The Baltimore and Ohio Railroad has numerous spurs and sidetracks adjacent to the plant, which are used for the storage of rail cars and track maintenance vehicles.

Manufacturing, warehousing, and shipping activities are conducted within a complex of interconnected buildings, which cover approximately 5.6 acres of the 13-acre site. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas. The building locations are shown on Figure 1-2.

A variety of businesses operate in the immediate vicinity of the plant, including: Ohio Packaging (paper supplier) to the south, sand and gravel quarries to the west and northwest, Carter Lumber (retail) and Price Brothers, Inc. (concrete pipe) to the north, and the Consumer Water Service (public water supply) waterworks and an automobile reclamation site to the east and northeast. An inactive municipal landfill reportedly exists just east of Consumer Water Service. The City of Massillon is believed to have been the principal user of the landfill; however, other users may also have been involved. The landfill was apparently informally operated, that is, no weigh station or access control was believed to have been present, and the landfill was not fenced. It is unclear whether records of ownership, methods of operation, or methods of "closure" have been retained.

1.4 FACILITY HISTORY

The first recorded activities occurred at the facility in approximately 1929, when the property was owned by Standard Oil Company. From approximately 1929 to 1942 Fort Pitt/Massillon Bridge Works manufactured iron and steel bridges and structural iron. In 1945, the Massillon facility was manufacturing aluminum and stainless steel cookware. By 1951, with the United States' involvement in the Korean Conflict, the plant was manufacturing 90 mm and 105 mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells, W-1 and W-2, at the facility (Figure 1-2). In 1953, a sewer was constructed which carried the plant waste to a discharge point along Newman Creek. At approximately the same time, a surface impoundment was constructed along the northern property boundary

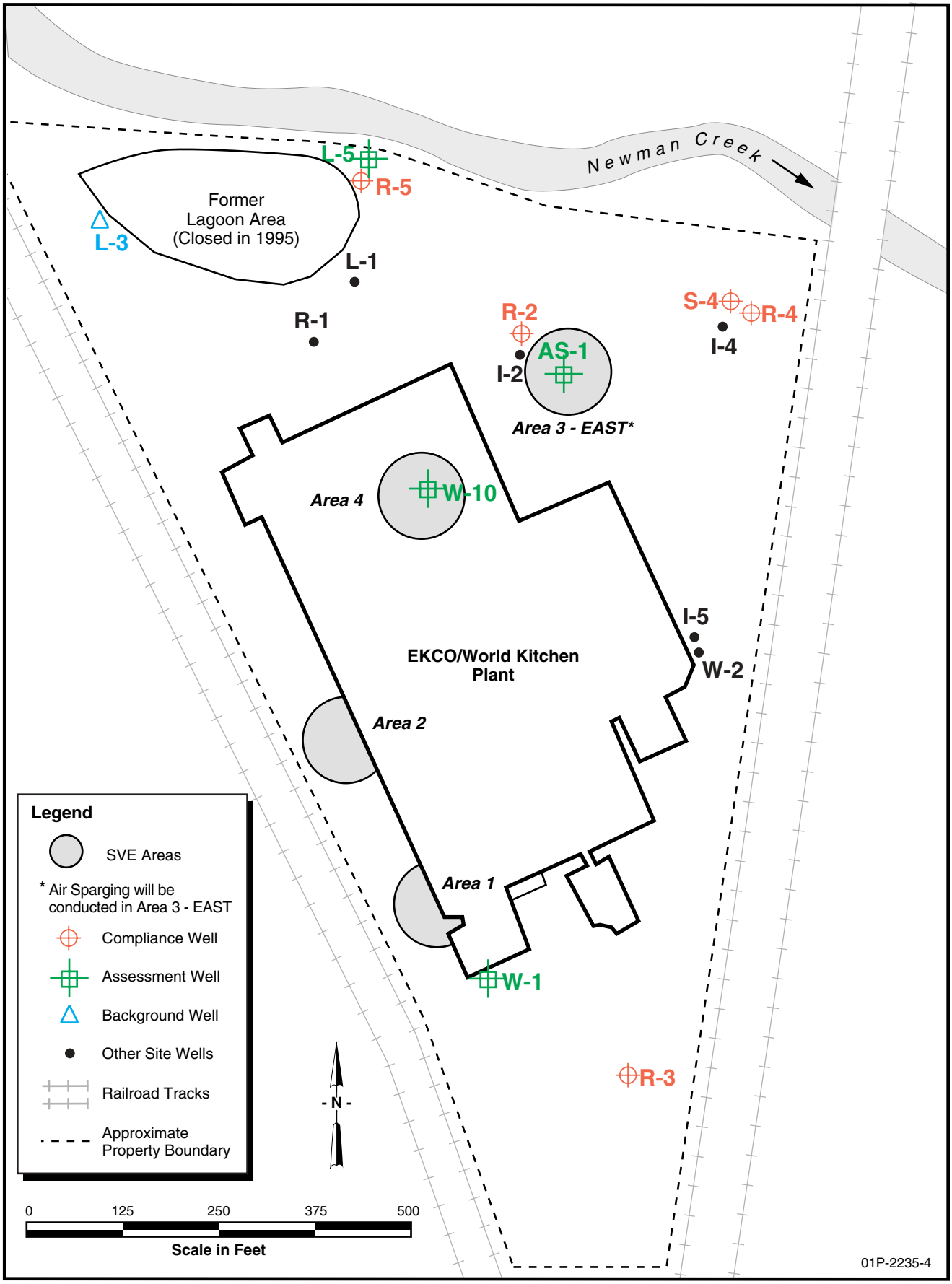

FIGURE 1-2 EKCO – MASSILLON, OHIO PROJECT GROUNDWATER MONITORING PROGRAM WELLS AND SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING AREAS

adjacent to Newman Creek. Wastewaters from manufacturing were discharged to the surface impoundment.

During 1954, the facility began alternate manufacturing operations. The primary function of these operations was returned to manufacturing cookware at the facility. Solvents (primarily trichloroethene [TCE] or 1,1,1-trichloroethane [1,1,1-TCA]) were used to clean the products prior to continuing production. These solvents were used for cleaning purposes until 1994. In 1994, the solvents were replaced with a Borax aqueous cleaner which is still used at the facility. No chlorinated solvents have been used at the facility since 1994.

By 1967, trends in the cookware manufacturing industry had changed, resulting in the installation of porcelain- and Teflon-coating units. In 1969, with the development of new NPDES regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to accept waste products associated with plant activities. These waste products have included:

- Deionizers from plant operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain-Teflon-coated aluminum cookware (aluminum frit, various coloring inorganics oxides, lead, cadmium, selenium, cobalt).
- Alkaline washer fluids to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued for the facility. As the 1970's progressed, the facility discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper-coating operations had ended and the principal products manufactured at the facility became pressed and coated non-stick bakeware.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the Corrective Measures Study (CMS). This correction is based on more recent review of historical plant documents.

The surface impoundment was reactivated in 1980 under the existing NPDES permit, and received housing degreaser filter water until mid-1984. The surface impoundment was finally

decommissioned in December 1985. In March 1984, when the plant applied for a renewal of their NPDES permit, analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at the facility. The waste stream was diverted from the surface impoundment to discharge in Newman Creek in December 1985. At that time, the surface impoundment (lagoon) was permanently taken out of service.

In 1992, the facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area. During 1993 and 1994, Roy F. Weston, Inc. (WESTON®) was retained by AHP to pursue a clean closure for the lagoon. Closure activities were conducted at the site from August 1993 to June 1994. A closure certification report was submitted to the OEPA in July 1994, and approval of the lagoon closure was issued in January 1995. Now that the lagoon is officially closed, quarterly groundwater sampling of the lagoon wells is no longer required for the RCRA lagoon closure.

WKI (formerly EKCO) continues to manufacture pressed and coated non-stick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface. A detailed description of the historical environmental investigations and a table summarizing the facility history are provided in the Community Relations Plan (Consent Order Reports and Plans, Vol. 1).

2. PROJECT TEAM

2.1 CONTACT INFORMATION

At the direction of Wyeth and WKI, Weston Solutions, Inc. (WESTON®) will manage all phases of the project. WESTON will perform the field investigation, prepare the reports, and perform all subsequent studies. Project management will be provided by Matt Basso (Wyeth), Jeff Burman (WKI), and Ken Bardo (U.S. EPA RCRA Project Manager [RPM]). Management responsibilities of key project personnel are defined in Subsection 2.2. Contact information is provided in the following table:

Name/Title	Company	Address	Phone/Fax	e-mail
Matt Basso/Project Manager	Wyeth	100 Campus Dr., Florham Park, NJ 07932	Ph: (973)683-2273 Fax: (973) 683-2281	bassom@wyeth.com
Jeff Burman/Project Manager.	WKI	359 State St. ext. NW, Massillon, OH 44648	Ph: (330) 832-5026 Fax: (330) 833-8003	BurmanJL@WorldKitchen.com
Ken Bardo/Project Manager	U.S. EPA (V)	77 W. Jackson Blvd, Chicago, IL 60604	Ph: (312) 886-7566 Fax: (312) 353-4342	Bardo.kenneth@epa.gov
Tom Cornuet/Technical Consultant Leader	WESTON	1400 Weston Way, West Chester, PA 19380	Ph: (610) 701-7360 Fax: (610) 701-7401	tom.cornuet@westonsolutions.com
Eric Lang/ Laboratory Manager	Severn Trent Laboratory	2417 Bond St. University Park, IL 60466	Ph.: (708) 534-5200 Fax: (708) 534-5211	Elang@STL-inc.com

The qualifications for the Technical Consultant Leader are provided in Appendix A.

2.2 ROLES AND RESPONSIBILITIES

The Wyeth Project Manager, Matt Basso, is responsible for implementation of the Administrative Order on Consent (Consent Order) and Scope of Work. The U.S. EPA Region V has approved the Consent Order and Consent Order Scope of Work. The U.S. EPA Project Manager, Ken Bardo, will provide oversight for the project. The WKI Project Manager, Jeff Burman, is responsible for ensuring that Wyeth and any and all employees, agents and contractors of Wyeth, be given access to the facility, and WKI's records relating to the Consent Order, at all reasonable times and at all places necessary for the purpose of performing all of the tasks and responsibilities set forth in this Consent Order and the attachments hereto and for the purpose of conducting oversight of the same.

The WESTON Technical Consultant Leader, Tom Cornuet, is responsible for implementing the project, and has been provided the authority from Wyeth and WKI to commit the resources necessary to meet project objectives and requirements. WESTON's primary function is to ensure that technical, financial, and scheduling objectives are achieved.

The WESTON Technical Consultant Leader will report directly to the Wyeth Project Manager and is responsible for ensuring that the project meets U.S. EPA's objectives and WESTON quality standards. The WESTON Technical Consultant Leader is also responsible for technical quality control (QC) and project oversight.

The WESTON Technical Consultant Leader will be supported by the WESTON field team leader. The WESTON field team leader is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his/her supervision. The WESTON field team leader is a highly experienced environmental professional, who will report directly to the WESTON Project Manager.

The technical staff for this project will be drawn from WESTON's pool of corporate resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

The Laboratory Manager, Eric Lang, will report directly to the WESTON Technical Consultant Leader, Tom Cornuet, and will be responsible for the following:

- Ensuring all resources of the laboratory are available on an as-required basis.
- Overseeing production and final review of analytical reports.

3. TECHNICAL APPROACH

The RCRA Facility Investigation (RFI) results show that soil and groundwater contaminated with volatile organic compounds (VOCs) at the WKI (former EKCO) facility should be remediated. A number of remediation alternatives for cleaning up soil and groundwater contamination were identified and evaluated during the CMS. The alternatives are described and compared in detail in the CMS report, which is available for review at the following location:

Massillon Public Library
208 Lincoln Way East
Massillon, OH 44646
(330) 832-9831.

3.1 REMEDIATION OBJECTIVES

Objectives for cleanup at the facility include:

- Achieving regulatory standards for VOCs detected in soil and groundwater at the facility.
- Continuing the prevention of contaminant migration from the facility property.

The selected alternative, which will successfully meet all of these objectives, is scheduled for implementation beginning in the fall of 2002.

3.2 SELECTED CORRECTIVE MEASURES ALTERNATIVES

Based on the CMS (November 1993) and the CMS Addendum (July 1994), the U.S. EPA has identified and approved the alternatives that will most effectively clean up VOCs at the facility. The selected cleanup alternatives include measures for cleaning up groundwater and identified areas of soil, including one area beneath and three areas outside the facility building. The site monitor wells and remediation areas are shown in Figure 1-2. The selected alternatives consist of the components discussed below.

VOCs in the shallow groundwater in Area 3-East will be removed by a process called “air sparging” (AS), also known as “in situ air stripping.” AS is an effective option for treating

groundwater contaminated with VOCs. The process transfers VOCs, which evaporate easily when exposed to air, from a liquid to a vapor phase. A system of injection wells injects air into groundwater. VOCs dissolved in the groundwater will volatilize into the air as the air bubbles move through the impacted groundwater. Soil vapor extraction (SVE) wells are then used to collect vapor-phase VOCs as they migrate upward through the soil subsurface. Once contaminated vapors are removed from the soil subsurface, they are treated using a vapor treatment system such as granular activated carbon (GAC) filters, if necessary.

There is a groundwater extraction and air stripping system currently being used at the facility, which will continue to be operated to provide further groundwater containment and treatment beneath the entire site. Groundwater will continue to be monitored to ensure the effectiveness of treatment. Well permit restrictions and institutional controls will be placed on the property to restrict the placement and pumping of water supply wells in or near the area of the contaminated groundwater, and to restrict the facility to non-residential water use only. The institutional controls and restrictions are further described in the Institutional Control Plan (Consent Order Reports and Plans Vol. I).

VOC-impacted soil as located beneath and outside the building will be treated by an SVE system to remove VOCs using the same process described above. Air extraction vents will be installed in each contaminated soil area. The removed VOCs will be treated using GAC filters, if necessary. SVE vents will be installed into all four areas, Area-1, Area-2, Area-3 East, and Area-4, to a total depth of approximately 10 to 25 ft below ground surface (bgs). SVE blowers will be used to create a vacuum on each of the vents and remove contaminants from the subsurface. The system will include monitoring parts, gauges, and valves throughout the system so that contaminant load, pressures, and flow rates can be monitored and adjusted to evaluate and optimize system performance. The AS and SVE operation and maintenance procedures will be described in the Operation and Maintenance Plan.

3.3 PROJECT SCHEDULE AND ESTIMATED BUDGET

The project schedule as required by the Consent Order is depicted below.

Event	Due Date*
Execution of Consent Order	26 Aug. 2002
Designate a Project Manager for Wyeth, WKI, and U.S. EPA	14 days
Wyeth, WKI, and U.S. EPA must each designate a Project Manager and notify each other in writing	14 days
WKI must submit a Deed Notice to Stark County	45 days
Submit a Community Relations Plan	45 days
Submit an Institutional Control Plan	45 days
Submit a Project Management Plan	45 days
Submit a Data Management Plan	45 days
Submit a Sampling and Analysis Plan	60 days
Submit a Quality Assurance Project Plan	60 days
Submit a Site Health and Safety Plan	60 days
Submit first Progress Report and submit quarterly thereafter	60 days
Submit a cost estimate to complete work	90 days
Begin quarterly groundwater monitoring program for first 5 years and semi-annually thereafter**	90 days
Submit a Design Report for implementing IS-2, OS-3, and GW-6	90 days
Complete construction and begin operation of IS-2, OS-3, and GW-6***	12 months
Submit a Construction Completion Report and Operation and Maintenance Plan for IS-2, OS-3, and GW-6	15 months
Provide financial security within 30 days of U.S. EPA approval of cost estimate	U.S. EPA Dependent

* Due date is the time from the execution date of the Consent Order.

** Or other schedule as approved by U.S. EPA.

***IS-2: Indoor Soil Remediation Alternative No. 2
OS-3: Outdoor Soil Remediation Alternative No. 3
GW-6: Groundwater Remediation Alternative No. 6

Based on the CMS (November 1993) and the CMS Addendum (July 1994), the total estimated cost for treating contaminated groundwater is $3,259,700. The total estimated costs for treating contaminated soil is $771,000 for soil beneath the building, and $1,340,000 for soil outside the building. The site remediation areas are shown in Figure 1-2.

4. PROJECT CLOSEOUT PROCEDURES

The soil and groundwater remediation work that will be conducted for this project is described in the Scope of Work (Attachment 2 of the Consent Order). The Consent Order and Scope of Work are included as Appendix B of this plan. The processes by which the facility groundwater pump-and-treat, groundwater air sparging, and soil remediation systems can be terminated are summarized below.

4.1 FACILITY GROUNDWATER PUMP-AND-TREAT SYSTEM

Within 30 days after Wyeth determines that, based on validated site data, the groundwater performance standards have been attained at the facility, Wyeth must submit a written report to U.S. EPA for review and approval. This report must include a description of the performance monitoring to be performed to ensure that groundwater performance standards continue to be attained after the groundwater pump-and-treat system is no longer required to operate.

Within 30 days after the performance monitoring period has ended and Wyeth has validated site data, Wyeth must submit a second written report to U.S. EPA for review and approval. In this report, a registered professional engineer or geologist and Wyeth's Project Manager must state that the groundwater performance standards have been attained at the point of compliance in satisfaction of requirements of the Consent Order, to the best of their knowledge, or that Wyeth has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA.

Wyeth must revise both reports in response to U.S. EPA's written comments, if any, and resubmit them within 30 days of receipt of the comments from U.S. EPA, or under such other extended schedule as may be approved by U.S. EPA.

If U.S. EPA approves the second report and there have been no exceedances of groundwater performance standards during the performance monitoring period (or if Wyeth has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA), Wyeth may discontinue operating the groundwater pump-and-treat system, and the groundwater

sampling and reporting program, and Wyeth will have satisfied all groundwater remediation requirements of the Consent Order.

4.2 GROUNDWATER AIR SPARGING SYSTEM

Within 30 days after Wyeth determines that, based on validated site data, the groundwater performance standards have been attained in well AS-1 (shown in Figure 1-2), Wyeth must submit a written report to U.S. EPA for review and approval. This report must include a description of the performance monitoring to be performed to ensure that groundwater performance standards continue to be attained after the air sparging system is no longer required to operate.

Within 30 days after the performance monitoring period has ended and Wyeth has validated site data, Wyeth must submit a second written report to U.S. EPA for review and approval. In this report, a registered professional engineer or geologist and Wyeth's Project Manager must state that the groundwater performance standards have been attained in well AS-1 in full satisfaction of requirements of the Consent Order, to the best of their knowledge, or that Wyeth has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA.

Wyeth must revise both reports in response to U.S. EPA's written comments, if any, and resubmit them within 30 days of receipt of the comments from U.S. EPA, or under such other extended schedule as may be approved by U.S. EPA.

If U.S. EPA approves the demonstration and there have been no exceedances of groundwater performance standards during the performance monitoring period (or if Wyeth has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA), Wyeth may discontinue operating the groundwater air sparging system, the groundwater sampling of well AS-1 and reporting, and Wyeth will have satisfied all groundwater air sparging remediation requirements of the Consent Order.

4.3 SOIL REMEDIATION SYSTEM

Within 30 days after determining that the soil remediation is complete, Wyeth must submit a written report to U.S. EPA for review and approval. A registered professional engineer or

geologist and Wyeth's Project Manager must state in the report that the soil performance standards were attained in all SVE areas in full satisfaction of requirements of the Consent Order, to the best of their knowledge, or that Wyeth has attained alternative soil performance standards and/or alternative corrective measures approved by U.S. EPA. Wyeth must revise the report in response to U.S. EPA's written comments, if any, and resubmit the report within 30 days of receipt of the comments from U.S. EPA, or under such other extended schedule as approved by U.S. EPA. If U.S. EPA approves the demonstration and all soil confirmation samples are below the soil performance standards (or if Wyeth has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA), Wyeth may discontinue conducting soil remediation, sampling, maintenance, and reporting activities required under the Consent Order, and Wyeth will have satisfied all soil remediation requirements of the Consent Order.

4.4 CONSENT ORDER TERMINATION AND SATISFACTION

The process by which the Consent Order will be satisfied and all associated work can be terminated is explained in Section XVII of the Consent Order and is summarized below.

Wyeth or WKI may request that U.S. EPA issue a determination that either party has met the requirements of the Consent Order for all or a portion of the facility. Wyeth or WKI may also request that U.S. EPA issue a "no further interest" or "no further action" determination for all or a portion of the facility.

The Consent Order and all associated work shall terminate as to Wyeth when Wyeth demonstrates in writing to the satisfaction of U.S. EPA that all activities required of it under this Consent Order, including payment of any stipulated penalties owed and due, but not including Wyeth's continuing obligation to preserve all records, as required by this Consent Order, have been performed, and Wyeth and U.S. EPA execute an "Acknowledgment of Termination and Agreement on Record Preservation and Reservation of Rights (the "Acknowledgment"). This Consent Order shall terminate as to WKI when WKI demonstrates in writing to the satisfaction of U.S. EPA that all activities required of it under this Consent Order, including payment of any stipulated penalties owed and due, but not including WKI's continuing obligation to preserve all records, as required by this Consent Order, and maintain any necessary institutional controls, as

required by the Consent Order, have been performed, and WKI and U.S. EPA execute an "Acknowledgment of Termination and Agreement on Record Preservation and Reservation of Rights (the "Acknowledgment"). The determination required by U.S. EPA under this paragraph, and execution by U.S. EPA of the Acknowledgment shall not be unreasonably withheld or delayed.

5. REFERENCES

U.S. EPA, Region V. 2002. "Administrative Order on Consent. 26 August 2002."

U.S. EPA, Office of Solid Waste, Office of Waste Programs Enforcement.1994. *RCRA Corrective Action Plan.* OSWER Dir. 9902.3-2A.

Roy F. Weston, Inc. 1993. "RCRA Facility Investigation Report for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1993. "Addendum to the Corrective Measures Study for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1993. "Corrective Measures Study for EKCO Housewares, Inc., Massillon, Ohio."

APPENDIX A
TECHNICAL CONSULTANT LEADER QUALIFICATIONS

Qualifications
World Kitchen, Inc. Massillon, Ohio Facility
U.S. EPA ID #OHD 045-205-424

Technical Consultant Leader: Thomas Cornuet, P.G.

Tom Cornuet is a Technical Manager with Weston Solutions, Inc. and has more than 15 years experience in hydrogeologic site investigation and remediation work. He is a Registered Professional Geologist in the Commonwealth of Pennsylvania (PA PG003189G) with a B.S. in Geology (Indiana University of Pennsylvania, 1985) and M.S. in Engineering Geology (Drexel University, 1996). His areas of technical expertise include: site characterization, numerical groundwater flow and contaminant transport modeling, and remediation system design. His responsibilities have included technical and project management of many large soil and groundwater remediation projects during the past five years and he has worked on the WKI (former EKCO) project in Massillon, Ohio since 1988.

APPENDIX B
ADMINISTRATIVE ORDER ON CONSENT
AND SCOPE OF WORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

RECEIVED
SEP 12 2002

RECEIVED
AUG 26 2002
MATT BASSO

REPLY TO THE ATTENTION OF
DE-9J

August 22, 2002
CERTIFIED MAIL 7099 3400 0000 9585 3970
RETURN RECEIPT REQUESTED

Ms. Geraldine Smith, Esq.
Senior Corporate Counsel
American Home Products Corporation
Five Giralda Farms
Madison, NJ 07940

RE: RCRA 3008(h) Consent Order
World Kitchen, Inc.
OHD 045 205 424

Dear Ms. Smith:

RCRA-05- 2002-0010

This letter is to acknowledge receipt of the Section 3008(h) Administrative Order on Consent signed by American Home Products Corporation and World Kitchen, Inc. A fully executed copy of the Consent Order is enclosed.

Your cooperation in resolving this matter is appreciated.

Sincerely yours,

Joseph M. Boyle

Joseph M. Boyle, Chief
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

Enclosure

cc: Matthew Basso, American Home Products Corporation
Bryan N. Jones, EKCO Manufacturing of Ohio
Karen Nesbit, Ohio EPA

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

IN THE MATTER OF:	)	ADMINISTRATIVE ORDER ON CONSENT
World Kitchen, Inc. 359 State Avenue, Ext. N.W. Massillon, Ohio 44648-0560	)	U.S. EPA Docket No: RCRA-05- 2002 - 0010
EPA ID#: OHD 045 205 424	)	Proceeding under Section 3008(h) of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 6928(h).
and	)	
American Home Products Corporation Five Giralda Farms Madison, New Jersey 07940	)	
RESPONDENTS.	)	

US ENVIRONMENTAL PROTECTION AGENCY REGION V
'02 AUG 22 PM 4:45
REGIONAL

I. JURISDICTION

1. The Administrator of the United States Environmental Protection Agency ("U.S. EPA") is issuing this Administrative Order on Consent ("Order") to World Kitchen, Inc. ("WKI") and American Home Products Corporation ("AHP") under Section 3008(h) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act of 1976 (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. § 6928(h). The Administrator has delegated the authority to issue orders under Section 3008(h) of RCRA to the Chief, Enforcement and Compliance Assurance Branch; Waste, Pesticides and Toxics Division; U.S. EPA Region 5.

2. WKI owns and operates a facility that manufactures cookware at 359 State Avenue, Ext. N.W., Massillon, Ohio (the "facility"). The property on which the facility is located is triangular in shape and occupies approximately 13 acres of land. It is bordered to the north by Newman Creek, on the west by the Penn Central Railroad and on the east by the Baltimore and Ohio Railroad. The facility began operations in 1945 and currently manufactures pressed and coated non-stick bakeware. The facility was previously owned and operated by EKCO Housewares, Inc. ("EKCO"). AHP was EKCO's corporate parent.

3. WKI and AHP agree not to contest U.S. EPA's jurisdiction to issue this Order and/or to enforce its terms.

4. WKI and AHP waive any rights to request a hearing on this matter pursuant to Section 3008(b) of RCRA and 40 C.F.R. Part 24, and consent to the issuance of this Order

without a hearing under Section 3008(b) of RCRA as a Consent Order issued pursuant to Section 3008(h) of RCRA.

5. WKI and AHP do not admit the validity of or responsibility for any factual or legal conclusions or determination stated herein, and do not admit any violations of, or liability under, federal, state, local or common law, or any other liability of any kind. WKI and AHP do not admit the existence of any actual or potential danger, hazard, or harm to any person, property, political entity or agency, the environment, or the public health or welfare. WKI and AHP agree that this Order shall be admissible as evidence in any proceeding brought by U.S. EPA to enforce this Order or to enforce the implementation of any corrective measure deemed necessary by U.S. EPA under the terms of the Order. However, all three parties agree that this Order shall not constitute or be construed as an admission of any kind, or be admissible as evidence of an admission of any kind, on the part of WKI or AHP, in whole or in part, in any other administrative or judicial proceeding.

II. DEFINITIONS

6. This Order incorporates the definitions in RCRA, 42 U.S.C. §§ 6901 - 6922k, and the regulations promulgated under RCRA unless otherwise specified.

7. "Day" means a calendar day unless expressly stated to be a business day. "Business Day" means a day other than a Saturday, Sunday or Federal Holiday. In computing any period of time under this Order, where the last day would fall on a Saturday, Sunday, or Federal Holiday, the period will run until the end of the next business day.

8. "Facility" means all contiguous property as described in paragraph 2, above, under the control of the owner and/or operator.

9. "U.S. EPA" means the United States Environmental Protection Agency and any successor departments or agencies of the United States.

III. PARTIES BOUND

10. This Order applies to and binds U.S. EPA, WKI and AHP and their agents, successors, assigns, trustees, receivers, and all persons, including but not limited to contractors and consultants, acting on behalf of WKI or AHP. WKI or AHP will be responsible for and liable for any violations of provisions of this Order to which they are subject, regardless of their use of employees, agents, contractors, or consultants to perform work required by this Order.

11. No change in ownership or corporate or partnership status relating to the facility will alter the obligations of WKI or AHP under this Order; provided however, that with the express prior written consent of U.S. EPA, WKI or AHP may assign one or more of their obligations under this Order. Any conveyance of title, easement, or other interest in the facility, or a portion

of the facility, will not affect WKI's or AHP's obligations under this Order. WKI will give written notice of this Order to any successor in interest prior to transferring ownership or operation of the facility or a portion thereof and will notify U.S. EPA and AHP in writing within five days of the transfer. This written notice will describe how WKI has assured that, despite the transfer, all institutional controls required now or in the future for the facility will be implemented and maintained and all other obligations of WKI under this Order fulfilled. WKI shall condition any transfer of ownership or operation of the facility or any portion thereof, and any lease of any portion of the facility upon which activities called for under this Order may be conducted, upon the agreement of any such transferee or lessee to comply with the obligations to which WKI is subject under this Order. No such agreement shall alter WKI's obligations under this Order. This paragraph will not apply if U.S. EPA, WKI and AHP agree that this Order has terminated as to the facility or any relevant portion of the facility, or if this Order has otherwise terminated pursuant to Section XVII of this Order.

IV. DETERMINATIONS

12. After consideration of the Administrative Record, the Chief, Enforcement and Compliance Assurance Branch; Waste, Pesticides and Toxics Division; U.S. EPA Region 5 has made the following conclusions of law and determinations:

a. WKI and AHP are "persons" within the meaning of Section 1004(15) of RCRA.

b. WKI is the owner or operator of a facility that has operated under interim status subject to Section 3005(e) of RCRA.

c. Certain wastes and constituents found at the facility are hazardous wastes and/or hazardous constituents pursuant to Sections 1004(5), 3001 of RCRA and 40 C.F.R. Part 261.

d. There is or has been a release of hazardous wastes or hazardous constituents into the environment from the facility.

e. The actions required by this Order are necessary to protect human health or the environment.

V. PROJECT MANAGER

13. U.S. EPA, WKI and AHP must each designate a Project Manager and notify each other in writing of the Project Manager selected within 14 days of the effective date of this Order. Each Project Manager will be responsible for overseeing the implementation of this Project. The parties must provide prompt written notice whenever they change Project Managers.

VI. WORK TO BE PERFORMED

14. Pursuant to Section 3008(h) of RCRA, WKI and AHP agree to and are hereby ordered to perform the actions specified in this section, in the manner and by the dates specified herein. WKI and AHP represent that they have the technical and financial ability to carry out corrective action at the facility. WKI and AHP must perform the work undertaken pursuant to this Order in compliance with RCRA and other applicable federal and state laws and their implementing regulations, and consistent with all relevant portions of U.S. EPA guidance documents applicable to the work to be performed under this Order. This guidance potentially includes, but is not limited to, the Documentation of Environmental Indicator Determination Guidance, Use of Institutional Controls in the RCRA Corrective Action Program, and relevant portions of U.S. EPA's risk assessment guidance. All work undertaken pursuant to this Order shall be performed in a manner consistent with the Scope of Work in Attachment 2 to this Order and incorporated herein by reference.

15. WKI and AHP must implement the remedy selected in U.S. EPA's April 23, 2001 Final Decision in accordance with the Scope of Work in Attachment 2 and as identified below. The components of the selected remedy include:

a. Air sparging of shallow groundwater and collection using soil vapor extraction (to be implemented by AHP);

b. Extraction of contaminated groundwater in the bedrock aquifer and treatment by air stripping (to be implemented by AHP);

c. Implementation of a groundwater monitoring program to monitor the shallow and bedrock aquifers at the facility (to be implemented by AHP);

d. Well permit restrictions (to be implemented by WKI);

e. Institutional controls to restrict the facility to non-residential use only (to be implemented by WKI); and

f. Soil vapor extraction to treat contaminated soil (to be implemented by AHP).

16. A detailed schedule to construct and implement the selected remedy required by paragraph 15a., b., c., and f., and to submit a Final Remedy Construction Completion Report is set forth in the attached Scope of Work.

17. Consistent with the attached Scope of Work, AHP must complete the items identified in paragraph 15.a., b., and c., above, including but not limited to, demonstrating that

the groundwater performance standards[1] or U.S. EPA-approved alternative corrective measures for groundwater have been met.

18. Consistent with the attached Scope of Work, AHP must complete the item identified in paragraph 15.f., above, including but not limited to, demonstrating that the soil performance standards for contaminated soil subject to soil vapor extraction[2] or U.S. EPA-approved alternative corrective measures for contaminated soil are met.

19. After AHP determines that groundwater performance standards or U.S. EPA-approved alternative corrective measures for groundwater have been attained at the facility, AHP must submit written reports to U.S. EPA for review and approval in accordance with the attached Scope of Work. After AHP determines that soil performance standards for contaminated soil subject to soil vapor extraction or U.S. EPA-approved alternative corrective measures for contaminated soil have been attained at the facility, AHP must submit written reports to U.S. EPA for review and approval in accordance with the attached Scope of Work.

20. AHP must continue to stabilize the migration of contaminated groundwater. This includes maintaining any corrective measures necessary to stabilize the migration of contaminated groundwater. Groundwater monitoring described in the attached Scope of Work must be conducted to confirm that any contaminated groundwater above the groundwater performance standards in Table 4 of Attachment 1 remains within the original area of contamination. U.S. EPA will consider AHP in compliance with the requirements of this paragraph if groundwater elevation contour maps of the water-bearing units at the facility, as prepared by AHP using groundwater monitoring data collected in accordance with the Scope of Work, show that groundwater continues to flow inward toward production wells W-1 and W-10.

21. WKI must not allow water from any existing wells at the facility to be used for drinking, bathing, washing, or other human contact purposes or for livestock, farming or irrigation until the groundwater performance standards specified in Table 4 of Attachment 1 to this Order are achieved. WKI must also not allow the installation of any new water wells for drinking, bathing, washing, or other human contact purposes or for livestock, farming or irrigation on this property until the groundwater performance standards specified in Table 4 of Attachment 1 to this Order are achieved.

22. WKI must not allow any residential activities at the facility for as long as soils at the facility remain contaminated above the residential soil performance standards for human

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[1] The groundwater performance standards for contaminants of concern in groundwater at and from the facility are found in Table 4 of Attachment 1 to this Order.

[2] The soil performance standards for protecting groundwater at the facility are found in Table 1 of Attachment 1 to this Order.

exposure.[3] The term "residential activities" shall include, but not be limited to, the following:

a. Single and multi-family dwelling and rental units;

b. Day care centers and preschools;

c. Hotels and motels;

d. Educational (except as a part of industrial activities at the facility) and religious facilities;

e. Restaurants and other food and beverage services (except as a part of industrial activities at the facility);

f. Entertainment and recreational facilities (except as a part of industrial activities at the facility);

g. Hospitals and other extended care medical facilities (except as a part of industrial activities at the facility); and

h. Transient or other residential facilities.

The term "industrial activities" shall include manufacturing, processing operations and office and warehouse use including, but not limited to, production, storage and sales of durable goods and other non-food chain products and parking/driveway use.

23. WKI must restrict activities at the facility that may reasonably result in human exposure to soil at unacceptable risk levels.[4] The point of compliance for restricting activities is at any point where direct contact exposure to soil may reasonably occur.

24. If WKI cleans up contaminated soil at the facility to the residential soil performance standards for human exposure and demonstrates to U.S. EPA that these standards have been achieved, WKI will no longer be bound by the restrictions in paragraphs 22 and 23.

25. WKI must restrict the use of the facility for any activities that may interfere with a remedial action, operation and maintenance, monitoring, or other measures necessary to assure

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[3] The residential soil performance standards for human exposure to contaminants of concern at the facility are found in Table 3 of Attachment 1 to this Order.

[4] The industrial soil performance standards for human exposure to contaminants of concern at the facility are found in Table 2 of Attachment 1 to this Order.

the effectiveness and integrity of the remedy to be implemented pursuant to this Order. Such restrictions include, but are not limited to:

a. Pumping of groundwater that impacts the effectiveness of the on-site pump-and-treat system in maintaining an inward groundwater gradient from the facility boundary to the two active industrial water wells. WKI must also notify adjacent landowners, and affected state and local governments of the pump-and-treat groundwater remedy at its facility. WKI must also use due diligence to detect any current and/or future off-site groundwater pumping activities that may (i) impact AHP's ability to prevent off-site migration of contaminated groundwater from the facility or (ii) impact the inward groundwater gradient from the facility boundary toward its two pumping industrial water wells and promptly notify U.S EPA, AHP and appropriate state and local governments if it becomes aware of such activities. Due diligence shall include, but is not limited to, a semi-annual review of available State and local records pertaining to (i) releases of hazardous substances, pollutants, or contaminants to the environment, and (ii) groundwater well installation permits, and construction project de-watering permits, and increases in well pumping rates associated with activities within a 0.50-mile radius of the facility. WKI shall provide AHP written notification of the results of its review of these records by January 15 and July 15 of each year during which this Order is in effect, unless U.S. EPA and AHP agree to an alternate schedule; and

b. The installation, construction, removal, or use of any wells or the excavation of any soil within areas exceeding soil cleanup goals as designated by U.S. EPA in its 12/13/2000 letter to EKCO except as approved by U.S. EPA as consistent with this Order.

26. WKI must record with the Office of Recorder, Stark County, Ohio, a deed notice in the chain of title for the facility which, at a minimum, includes the restrictions specified in paragraphs 21 through 23 and paragraph 25 of the Order. Within 45 days of the effective date of this Order, WKI must submit the notice to U.S. EPA for review and approval. Within 15 days of U.S. EPA's approval, WKI must record the deed notice. Within 30 days of recording the deed notice, WKI must provide U.S. EPA with a certified copy of the original recorded notice.

27. Within 90 days of the effective date of this Order, AHP must submit to U.S. EPA for review and approval an estimate of the cost for AHP to assure completion of the work to be performed pursuant to this Order. Within 30 days of U.S. EPA's approval of the cost estimate, AHP must provide financial security, in the amount of the cost estimate, in one of the forms permitted under 40 C.F.R. § 264.145 (modified to replace the terms "post-closure" and "closure" with "corrective action" and referencing this Order, as approved by U.S. EPA). After U.S. EPA approval of the Final Remedy Construction Completion Report, AHP may submit to U.S. EPA for review and approval a revised estimate of the cost for AHP to assure completion of the

remaining work to be performed pursuant to this Order. Upon approval of the revised cost estimate by U.S. EPA, AHP may reduce the amount of financial security to the amount of the revised cost estimate approved by U.S. EPA.

28. Reporting and other requirements:

a. AHP and WKI must establish a publicly accessible repository for information regarding site activities and conduct public outreach and involvement activities.

b. AHP must provide quarterly progress reports to U.S. EPA by the fifteenth day of the month after the end of each quarter until this Order has been terminated unless otherwise agreed by U.S. EPA. The report must list work performed during the reporting period, as well as data collected and problems encountered during the reporting period, the project schedule, and the percent of the project completed.

c. The parties will communicate frequently and in good faith to assure successful completion of the requirements of this Order, and will meet on at least a semi-annual basis to discuss the work proposed and performed under this Order.

d. AHP must provide a Final Remedy Construction Completion Report documenting all work that AHP has performed pursuant to the schedule for construction and implementation of the selected remedy. A registered professional engineer and AHP's Project Manager shall state in the report that the selected remedy has been constructed and implemented in accordance with the design and specifications, to the best of their knowledge.

e. For ongoing monitoring and operation and maintenance after construction of the selected remedy, AHP must include an operations and maintenance plan in the Final Remedy Construction Completion Report. By the dates specified by U.S. EPA, AHP must revise and resubmit the report and plan in response to U.S. EPA's written comments, if any, consistent with the attached Scope of Work. Upon U.S. EPA's written approval, AHP must implement the approved operation and maintenance plan according to the schedule and terms of the plan.

f. All sampling and analysis conducted under this Order must be performed in accordance with the Region 5 RCRA Quality Assurance Project Plan Policy (April 1998) as appropriate for the facility, and be sufficient to identify and characterize the nature and extent of all releases as required by this Order. U.S. EPA may audit laboratories AHP selects or require AHP to purchase and have analyzed a reasonable number of performance evaluation samples selected by U.S. EPA which are compounds of concern to demonstrate the quality of the laboratory's analytical data. AHP must notify U.S. EPA in writing at least 14 days before beginning each separate phase of field work performed under this

Order. At the request of U.S. EPA, AHP will provide or allow U.S. EPA or its authorized representative to take split or duplicate samples of all samples AHP collects under this Order.

29. Project Managers can agree in writing to extend, for 90 days or less, any deadline in this Section. However, extensions of greater than 90 days require obtaining approval from the Chief of the Enforcement and Compliance Assurance Branch; Waste, Pesticides and Toxics Division, U.S. EPA Region 5.

30. WKI's obligations to allow AHP to perform the work described in this Order and all attachments hereto shall be as follows:

a. WKI shall allow AHP, and any and all employees, agents and contractors of AHP, access to the facility, and WKI's records relating to this Order, at all reasonable times and at all places necessary for the purpose of performing all of the tasks and responsibilities set forth in this Order and the attachments hereto and for the purpose of conducting oversight of the same.

b. WKI shall not contest or otherwise seek to hinder or impede any of the work to be performed by AHP, or any and all employees, agents and contractors of AHP, so long as the activities performed by AHP, or any of its employees, agents, or contractors do not materially interfere with (i) the structural integrity of the facility, or (ii) WKI's day-to-day operations of its facility during the pendency of this Order. Any disagreements concerning actions which may or may not constitute material interference as described above shall be resolved in accordance with the dispute resolution provisions set forth in Section X of this Order.

31. Other than for those acts and obligations for which WKI is responsible under the various provisions of this Order, AHP shall be liable for, and shall be obligated under and for the duration of this Order to do, all acts necessary to fulfill the requirements of this Order.

32. AHP may utilize studies, surveys, data, and reports previously prepared or collected concerning the facility, and may utilize wells and other equipment previously installed at the facility to the extent that such work, studies, surveys, data, wells, and equipment reliably and accurately reflect current conditions at the facility.

VII. ACCESS

33. Upon reasonable notice, and at reasonable times, U.S. EPA, its contractors, employees, and any designated U.S. EPA representatives may enter and freely move about the facility during the effective dates of this Order for the purpose of reviewing the progress of AHP and WKI in implementing the provisions of this Order by, among other things, interviewing facility personnel and contractors; conducting tests, sampling and monitoring as U.S. EPA deems

necessary; using a camera, sound recording, or other documentary equipment; and verifying the reports and data AHP submits to U.S. EPA. AHP and WKI will permit such persons to inspect and copy all non-privileged photographs and documents, including all sampling and monitoring data, that pertain to work undertaken under this Order and that are within the possession or under the control of AHP, WKI or their contractors or consultants. Upon request, U.S. EPA will provide AHP and WKI split samples of any samples collected by U.S. EPA, or by authorized representatives of U.S. EPA, and copies of all photographs, tapes, videos or other recorded evidence created by U.S. EPA and releaseable under the Freedom of Information Act including all analytical results and any technical data and reports collected or prepared by U.S. EPA.

34. To the extent that work being conducted pursuant to this Order must be done beyond the facility's property boundary, AHP must use its best efforts to obtain the necessary access agreements from the present owner(s) of such property within 30 days after AHP knows of the need for access. Any such access agreement must provide for access by U.S. EPA and its representatives. AHP must submit a copy of any access agreement to U.S. EPA's Project Manager. If it does not obtain agreements for access within 30 days, AHP must notify U.S. EPA in writing within 14 additional days of both the efforts undertaken to obtain access and the failure to obtain access agreements. U.S. EPA may, at its discretion, assist AHP in obtaining access.

35. Nothing in this Section limits or otherwise affects U.S. EPA's right of access and entry under applicable law, including RCRA and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601-9675.

VIII. RECORD PRESERVATION

36. AHP and WKI must retain, during the pendency of this Order and for at least six years after the Order terminates, all data and all final documents now in their possession or control or which come into their possession or control which relate to this Order. AHP and WKI must notify U.S. EPA in writing 90 days before destroying any such records, and give U.S. EPA the opportunity to take possession of any non-privileged documents. The notice of AHP and WKI will refer to the effective date, caption, and docket number of this Order and will be addressed to:

Director
Waste, Pesticides and Toxics Division
U.S. EPA Region 5
77 W. Jackson Blvd.
Chicago, IL 60604-3590

AHP and WKI will also promptly give U.S. EPA's Project Manager a copy of the notice.

37. Within 30 days of retaining or employing any agent, consultant, or contractor ("agents") to carry out the terms of this Order, AHP and WKI will enter into an agreement with their respective agents to give AHP and WKI a copy of all data and final non-privileged documents produced under this Order.

38. U.S. EPA, AHP and WKI will not assert any privilege claim concerning any validated data gathered during any investigations or other actions required by this Order.

IX. STIPULATED PENALTIES

39. AHP and WKI must pay the stipulated penalties set forth below to the United States for violations of this Order, unless (i) there has been a written modification of a compliance date by U.S. EPA, (ii) U.S. EPA has approved, in writing, AHP's or WKI's written request for an extension of time, (iii) a delay excusable pursuant to Section XI (Force Majeure and Excusable Delay) of this Order has arisen, (iv) payment of stipulated penalties has been excused by the Director of the Waste, Pesticides, and Toxics Division, U.S. EPA, Region 5 pursuant to Section X (Dispute Resolution), or (v) in the exercise of its unreviewable discretion, U.S. EPA has otherwise waived payment of any portion of or all stipulated penalties otherwise owed. AHP and WKI shall be jointly and severally liable for the stipulated penalties in paragraph 39.a. through 39.e.

a. AHP and/or WKI: For failure to submit progress reports by the dates scheduled in paragraph 28.b., above: $1,000 per day for the first 14 days and $2,000 per day thereafter.

b. AHP and/or WKI: For failure to implement, according to the schedule in the attached Scope of Work, the remedial components described in paragraphs 15a., b., c., and f. and 16: $3,000 per day for the first 14 days and $6,000 per day thereafter.

c. AHP and/or WKI: For failure to submit or revise and submit, the Final Remedy Construction Completion Report and operation and maintenance plan as required and scheduled in paragraphs 16 and 28: $1,000 per day for the first 14 days and $2,000 per day thereafter.

d. AHP and/or WKI: For failure to implement, according to the approved schedule and terms, the approved operation and maintenance plan: $2,000 per day for the first 14 days and $4,000 per day thereafter.

e. AHP and/or WKI: For failure to provide the cost estimate and financial security as required and scheduled in paragraph 27: $1,000 per day for the first 14 days and $2,000 per day thereafter.

f. WKI: For failure to maintain the institutional controls as required in paragraphs 21 through 23 and paragraph 25: $3,000 per day for the first 14 days and $6,000 per day thereafter.

g. WKI: For failure to submit for review or record a deed notice as required by paragraph 26: $2,000 per day for the first 14 days and $4,000 per day therafter.

h. WKI: For failure to refrain from contesting or otherwise seeking to hinder or impede any of the work to be performed by AHP, or any and all employees, agents, or contractors of AHP in violation of the provisions of paragraph 30.b.: $2,000 per day for the 14 days and $4,000 per day thereafter.

i. WKI: For failure to provide access required by paragraph 30.a.: $2000 per day for the first 14 days and $4,000 per day thereafter.

40. Except as otherwise provided in this Order, whether or not AHP or WKI has received notice of a violation, stipulated penalties will begin to accrue on the first day a violation occurs, and will continue to accrue until AHP or WKI complies. Separate stipulated penalties for separate violations of this Order will accrue simultaneously.

41. AHP and WKI must pay any stipulated penalties owed by them to the United States under this Section within 30 days of receiving U.S. EPA's written demand to pay the penalties, unless AHP or WKI invokes the dispute resolution procedures under Section X: Dispute Resolution. A written demand for stipulated penalties will describe the violation and will indicate the amount of penalties due.

42. Interest will begin to accrue on any unpaid stipulated penalty balance beginning 31 days after AHP's and/or WKI's receipt of U.S. EPA's demand letter or, if AHP or WKI invokes the dispute resolution provisions under Section X, AHP and/or WKI must pay interest, if any, according to the dispute resolution decision or agreement. Interest will accrue at the current value of funds rate established by the Secretary of the Treasury. Under 31 U.S.C. § 3717, AHP and/or WKI must pay an additional penalty of six percent per year on any unpaid stipulated penalty balance more than 90 days overdue.

43. AHP and/or WKI must pay all penalties by certified or cashier's check payable to the United States of America, or by wire transfer. Payment shall be remitted to:

U.S. Department of the Treasury
Attention: U.S. EPA Region 5, Office of the Comptroller
P.O. Box 70753
Chicago, Illinois 60673.

A transmittal letter stating the name of the facility, AHP's or WKI's name and address, and the U.S. EPA docket number of this action must accompany the payment. AHP or WKI will simultaneously send a copy of the check and transmittal letters to the U.S. EPA Project Manager.

44. AHP or WKI may dispute U.S. EPA's assessment of stipulated penalties by invoking the dispute resolution procedures under Section X: Dispute Resolution. The stipulated penalties in dispute will continue to accrue, but need not be paid, during the dispute resolution period. AHP or WKI must pay stipulated penalties and interest, if any, according to the dispute resolution decision or agreement. AHP or WKI must submit any such payment due to U.S. EPA within 30 days after receiving the resolution according to the payment instructions of this Section.

45. Neither invoking dispute resolution nor paying penalties will affect AHP's or WKI's obligation to comply with the terms of this Order not directly in dispute.

46. The stipulated penalties provided for in this Section do not preclude U.S. EPA from pursuing any other remedies or sanctions which may be available to U.S. EPA for AHP's or WKI's violation of any terms of this Order. However, U.S. EPA will not seek both a stipulated penalty under this Section and a statutory penalty for the same violation.

X. DISPUTE RESOLUTION

47. The parties to this Order recognize that disputes may arise between the parties regarding the work to be performed in Section VI or other provisions in this Order. The provisions of this Section X shall govern the resolution of such disputes regardless of whether these provisions are referenced elsewhere in the Order. The parties will use their best efforts to informally and in good faith resolve all disputes or differences of opinion.

48. If any party disagrees, in whole or in part, with any decision made or action taken under this Order, that party will notify the other relevant party's Project Manager of the dispute. The Project Managers will attempt to resolve the dispute informally.

49. If the Project Managers cannot resolve the dispute informally, any party may pursue the matter formally by placing its objections in writing and notifying the other party of its decision to invoke the dispute resolution provisions of this Section X. A written objection must state the specific points in dispute, the basis for that party's position, and any matters which that party considers necessary for determination. Within 14 days after receipt of a written objection, the other party will respond in writing.

50. The parties will in good faith attempt to resolve the dispute through formal negotiations within 21 days from receipt of the objections to the position of the party originally providing notice, or a longer period if agreed in writing by the parties. During formal

negotiations, any party may request a conference with appropriate senior management to discuss the dispute.

51. If the parties are unable to reach an agreement through formal negotiations, the matter shall be referred to the Director of the Waste, Pesticides and Toxics Division, U.S. EPA Region 5. Within 10 business days after any formal negotiations end, the parties may submit additional written information and supplemental statements of position to the Director. No representative of any party shall engage in ex parte discussions with the Director regarding the matter in dispute. U.S. EPA will maintain a record of the dispute, which will contain all written statements of position and any other documentation submitted pursuant to the terms of this Section. Based on the record, U.S. EPA will respond to AHP's or WKI's arguments and evidence and provide a detailed written decision on the dispute signed by the Director of the Waste, Pesticides and Toxics Division, U.S. EPA Region 5 ("EPA Dispute Decision"). In deciding whether stipulated penalties and/or interest, if any, must be paid, the Director of the Waste, Pesticides and Toxics Division may consider, among other factors deemed relevant, whether AHP or WKI initiated dispute resolution, and continued to negotiate a resolution of the dispute in good faith.

XI. FORCE MAJEURE AND EXCUSABLE DELAY

52. AHP and WKI shall perform the requirements of this Order within the time periods set forth or approved herein, except to the extent that performance is prevented or delayed by events which constitute a force majeure. Force majeure, for purposes of this Order, is any event arising from causes not foreseen and beyond AHP's or WKI's control that delays or prevents the timely performance of any obligation under this Order despite AHP's or WKI's best efforts. "Best efforts" include using best efforts to anticipate any potential force majeure event and address it during and after its occurrence, such that any delay or prevention of performance is minimized to the greatest extent possible. Force majeure does not include increased costs of the work to be performed under this Order, financial inability to complete the work, work stoppages or other labor disputes.

53. If any event occurs or has occurred that may delay or prevent the performance of any obligation under this Order, whether or not caused by a force majeure event, AHP or WKI must notify U.S. EPA by telephone within two business days after learning that the event may cause a delay. If AHP or WKI wishes to claim a force majeure event, within 15 business days thereafter AHP or WKI must provide to U.S. EPA in writing all relevant information relating to the claim, including a proposed revised schedule.

54. If U.S. EPA determines that a delay or anticipated delay is attributable to a force majeure event, U.S. EPA will extend in writing the time to perform the obligation affected by the force majeure event and any other obligation whose performance depends upon performance of the obligation affected by a force majeure event for such time as U.S. EPA determines is necessary to complete the obligation or obligations.

XII. MODIFICATION

55. This Order may be modified only by mutual agreement of U.S. EPA and AHP and WKI, except as provided in paragraph 29 of Section VI - Work to be Performed. Any agreed modifications will be in writing, will be signed by all parties, will be effective on the date specified therein and will be incorporated into this Order.

XIII. RESERVATION OF RIGHTS

56. Nothing in this Order restricts U.S. EPA's authority to seek AHPs or WKI's compliance with the Order and applicable laws and regulations. In addition, U.S. EPA specifically reserves its rights to bring an action to compel WKI to perform any work required to be performed by AHP under this Order that is not performed by AHP in accordance with the provisions of this Order and/or the attached Scope of Work. For violations of this Order, U.S. EPA reserves its rights to bring an action to enforce the Order, to assess penalties under Section 3008(h)(2) of RCRA, 42 U.S.C. § 6928(h)(2) (except as otherwise provided in paragraph 46), and to issue an administrative order to perform additional corrective actions or other response measures. In any later proceeding, AHP and WKI shall not assert or maintain any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon a contention that the claims raised by the United States in the later proceeding were or should have been raised here. Except as otherwise expressly provided in paragraph 38, 46 or 57, this Order is not a covenant not to sue, release, waiver, or limitation of any rights, remedies, powers, or authorities of U.S. EPA.

57. U.S. EPA reserves all of its rights to perform any portion of the work consented to here or any additional site characterization, feasibility study, and remedial work as it deems necessary to protect human health or the environment. Notwithstanding the foregoing sentence, U.S. EPA agrees not to perform any work required to be performed by AHP or WKI under this Order if AHP or WKI is in compliance with the terms of this Order.

58. If U.S. EPA determines that the actions of AHP or WKI related to this Order have caused or may cause a release of hazardous waste or hazardous constituent(s), or a threat to human health or the environment, or that AHP or WKI cannot perform any of the work ordered, U.S. EPA may order AHP or WKI to stop implementing this Order for the time U.S. EPA determines may be needed to abate the release or threat and to take any action that U.S. EPA determines is necessary to abate the release or threat.

59. Except for the specific waivers expressly set forth in this Order, AHP and WKI reserve all of their rights, remedies and defenses, including, but not limited to, all rights and defenses they may have: (a) to challenge U.S. EPA's performance of work or issuance of orders requiring AHP or WKI to perform additional work or incur additional expenses; (b) to challenge U.S. EPA's stop work orders; (c) regarding liability or responsibility for conditions at the facility, except for their right to contest U.S. EPA's jurisdiction to issue or enforce this Order;

and (d) against all parties and entities not bound by this Order. AHP and WKI have entered into this Order in good faith without trial or adjudication of any issue of fact or law. AHP and WKI reserve their right to seek judicial review of U.S. EPA actions taken under this Order, including, but not limited to, a proceeding brought by the United States to enforce the Order or to collect penalties for violations of the Order.

XIV. OTHER CLAIMS

60. AHP and WKI waive any claims or demands for compensation or payment under Section 106(b), 111, and 112 of CERCLA against the United States or the Hazardous Substance Superfund established by 26 U.S.C. § 9507 for, or arising out of, any activity performed or expense incurred under this Order. Additionally, this Order is not a decision on preauthorization of funds under Section 111(a)(2) of CERCLA.

61. Nothing in this Order shall constitute or be construed as a release by any party bound by this Order of any claim, cause of action, or demand, in law or equity, against any other person, firm, partnership, corporation, or other entity for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, disposal or release of any hazardous waste constituents, hazardous wastes, hazardous substances, pollutants or contaminants found at, released from, or taken from the facility.

XV. INDEMNIFICATION OF THE UNITED STATES GOVERNMENT

62. AHP agrees to indemnify, save and hold harmless the United States, its agencies, departments, agents, and employees, from all claims or causes of action arising solely from or on account of acts or omissions of AHP or its officers, employees, agents, independent contractors, receivers, trustees, and assigns in carrying out activities required by this Order. WKI agrees to indemnify, save and hold harmless the United States, its agencies, departments, agents, and employees, from all claims or causes of action arising solely from or on account of acts or omissions of WKI or its officers, employees, agents, independent contractors, receivers, trustees, and assigns in carrying out activities required by this Order. These indemnifications will not affect or limit the rights or obligations of AHP, WKI, or the United States under their various contracts. These indemnifications will not create any obligation on the part of AHP or WKI to indemnify the United States from claims arising solely from the acts or omissions of the United States, its agencies, departments, agents, or employees.

XVI. SEVERABILITY

63. If any judicial or administrative authority holds any provision of this Order to be invalid, the remaining provisions will remain in force and will not be affected.

XVII. TERMINATION AND SATISFACTION

64. AHP or WKI may request that U.S. EPA issue a determination that either party has met the requirements of the Order for all or a portion of the facility. AHP or WKI may also request that U.S. EPA issue a "no further interest" or "no further action" determination for all or a portion of the facility.

65. This Order shall terminate as to AHP when AHP demonstrates in writing to the satisfaction of U.S. EPA that all activities required of it under this Order, including payment of any stipulated penalties owed and due, but not including AHP's continuing obligation to preserve all records, as required by this Order, have been performed, and AHP and U.S. EPA execute an "Acknowledgment of Termination and Agreement on Record Preservation and Reservation of Rights" (the "Acknowledgment"). This Order shall terminate as to WKI when WKI demonstrates in writing to the satisfaction of U.S. EPA that all activities required of it under this Order, including payment of any stipulated penalties owed and due, but not including WKI's continuing obligation to preserve all records, as required by this Order, and maintain any necessary institutional controls, as required by paragraphs 21 through 23 and 25 of this Order, have been performed, and WKI and U.S. EPA execute an "Acknowledgment of Termination and Agreement on Record Preservation and Reservation of Rights" (the "Acknowledgment"). The determination required by U.S. EPA under this paragraph, and execution by U.S. EPA of the Acknowledgment, shall not be unreasonably withheld or delayed.

66. AHP's and WKI's execution of the Acknowledgment will affirm their continuing obligation to preserve all records as required by Section VIII, to maintain (in the case of WKI) any necessary institutional controls or other long term measures as required in Section VI, and to recognize U.S. EPA's reservation of rights as set forth in Section XIII.

67. The failure of U.S. EPA to make the determination required by paragraph 65, a U.S. EPA determination pursuant to that paragraph that AHP or WKI has not performed all activities required of them under this Order, or the failure of U.S. EPA to execute the Acknowledgment provided for in paragraph 65 upon submission by AHP or WKI of a demonstration provided for in that paragraph shall be subject to Section X (Dispute Resolution) of this Order.

XVIII. EFFECTIVE DATE

68. This Order is effective as to AHP and WKI upon receipt by each of them of a fully executed duplicate original of this Order signed by U.S. EPA. Except as specifically provided otherwise in this Order, all times for performance and compliance under this Order run from the effective date of this Order.

IT IS SO AGREED:

DATE: March 25, 2002 BY: [signature]

Name

VP - Environmental Affairs

Position

American Home Products Corp.
Respondent

DATE: August 8 2002 BY: [signature]

Name

General Counsel

Position

World Kitchen, Inc.
Respondent

IT IS SO ORDERED:

DATE: August 22, 2002 BY: Joseph M. Boyle

Joseph M. Boyle, Chief
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
U.S. Environmental Protection Agency
Region 5

RCRA-05- 2002-0010

ATTACHMENT 1

Table 1: Soil Performance Standards for Protecting Groundwater at the Facility

SOIL CONTAMINANT	SOIL CLEANUP LEVEL (µg/kg)
1,1-dichloroethylene	120
1,2-dichloroethylene (total)	1,500
1,1,1-trichloroethane	6,140
Trichloroethylene	230

Table 2: Industrial Soil Performance Standards for Human Exposure to Contaminants at the Facility

SOIL CONTAMINANT	SOIL CLEANUP LEVEL (µg/kg)
1,1-dichloroethylene	120
1,2-dichloroethylene (total)	150,000
1,1,1-trichloroethane	1,400,000
Trichloroethylene	6,100

Table 3: Residential Soil Performance Standards for Human Exposure to Contaminants at the Facility

SOIL CONTAMINANT	SOIL CLEANUP LEVEL (µg/kg)
1,1-dichloroethylene	54
1,2-dichloroethylene (total)	43,000
1,1,1-trichloroethane	630,000
Trichloroethylene	2,800

Table 4: Groundwater Performance Standards for the Facility

GROUNDWATER CONTAMINANT	GROUNDWATER CLEANUP LEVEL (µg/l)
1,1-dichloroethane	810
1,1-dichloroethylene	7
cis-1,2-dichloroethylene	70
trans-1,2-dichloroethylene	100
1,1,1-trichloroethane	200
Trichloroethylene	5
Vinyl chloride	2

ATTACHMENT 2

Scope of Work for Corrective Measures Implementation at the World Kitchen Facility in Massillon, Ohio

1. Introduction

This Scope of Work sets forth the work to be conducted to implement Section VI (Work to be Performed) of the Administrative Order on Consent (AOC) captioned In the Matter of: World Kitchen, Inc. and American Home Products Corp., U.S. EPA Docket No. Paragraphs 14 through 32 in Section VI of the AOC address the "Work to Be Performed" and Paragraphs 14 through 20 focus on the site soil and groundwater remediation and related activities. This Scope of Work identifies the soil and groundwater remediation work that will be performed under the AOC and includes the following sections:

- Schedule of Remediation and Consent Order Activities (Paragraphs 16, 17, and 18 of the AOC).
- Groundwater Remediation (Paragraphs 16, 17, and 20 of the AOC).
- Soil Remediation (Paragraphs 16 and 18 of the AOC).

In 1993, American Home Products Corp. (AHP) prepared a Final Corrective Measures Study (CMS) for the facility located at 359 State Avenue, Ext. N.W., Massillon, Ohio (the facility) which is currently owned and operated by World Kitchen, Inc. (WKI). The CMS estimates that it will take more than 30 years to clean up groundwater contamination at the WKI facility. U.S. EPA issued a Final Decision on April 23, 2001, that among other things, requires soil vapor extraction (SVE) to treat contaminated soil, air sparging of shallow groundwater and collection using SVE, and extraction of contaminated groundwater in the bedrock aquifer and treatment by air stripping. A summary of the current remediation status is provided below:

- As documented in the CMS, all contaminated groundwater beneath the facility is contained by the pumping of recovery wells W-1 and W-10 and is treated by the on-site air stripper installed in 1986.
- The planned groundwater remediation program to be implemented for the facility (CMS Alternative GW-6) consists of continuing the pump and treat system, incorporating pulse pumping of the recovery wells, and adding air sparging (AS) in the shallow zone.
- The soil remediation program recommended in the CMS was soil vapor extraction (SVE) in three areas (Area-1, Area-2, and Area-3) outside the building (CMS Alternative OS-3), and in one area (Area-4) inside the building (CMS Alternative IS-2). However, recent soil investigations have shown that soil remediation is no longer needed in one of the areas outside the building and that soil remediation is needed in an area not identified in the CMS (Weston, 2001). Area-3 has contaminant concentrations below the soil performance standards; therefore no soil remediation is needed in that area.

Contamination exceeding the soil performance standards is present east of Area-3 (Area-3 East). AHP will implement SVE in this area. Subsequent references to soil CMS Alternative OS-3 include conducting SVE in Area-3 East instead of Area-3. The soil vapor extraction areas are shown in Figure 1.

2. Schedule of Remediation and Consent Order Activities

A schedule for implementing the remediation activities is provided in Table 1. The schedule provides for, among other things, installation and startup of the air sparging/soil vapor extraction (AS/SVE) system within one year of the effective date of the AOC. The schedule also provides for the implementation of a quarterly groundwater monitoring program within 90 days of the effective date of the AOC.

In addition, AHP will provide the following documents to U.S. EPA in accordance with the attached schedule (see Table 1):

- Progress Reports
- Site Health and Safety Plan
- Sampling and Analysis Plan
- Quality Assurance Project Plan (consistent with U.S. EPA, 1998)
- Community Relations Plan
- Institutional Control Plan (consistent with U.S. EPA, 2000)
- Project Management Plan
- Data Management Plan
- Soil Vapor Extraction (IS-2 and OS-3) and Air Sparging (GW-6) Design Report
- Construction Completion Report and Operation and Maintenance Plan

3.0 Groundwater Remediation

This section discusses the following groundwater remediation activities that AHP will implement under the AOC:

- Groundwater Corrective Measures Alternative
- Groundwater Monitoring Program
- Groundwater Remediation Reporting
- Air Sparging System

3.1 Groundwater Corrective Measures Alternative

The groundwater remediation approach selected in U.S. EPA's Final Decision is Alternative GW-6 which consists of pulse pumping of groundwater from wells W-1 and W-10 with treatment via air stripping (hereafter referred to as the pump and treat system), and air sparging in the shallow groundwater. AHP will operate the groundwater remediation system continuously except for periodic maintenance activities. AHP will describe the required operation and maintenance procedures for the groundwater remediation system in the U.S. EPA-approved

Operations and Maintenance (O&M) Plan. The groundwater remediation system operations will be recorded either daily by on-site WKI maintenance personnel, or automatically with electronic data loggers. AHP will document the O&M activities and total operation time in the quarterly progress reports to be submitted under the AOC (the frequency of these reports may be modified upon approval by U.S. EPA).

Groundwater Pump and Treat System Completion: AHP may discontinue operating the groundwater pump and treat system based on the following process:

a) *AHP may discontinue operating the groundwater pump and treat system* once the sampling data from the groundwater monitoring program show that no groundwater performance standards (see 3.2 below) are exceeded at any compliance well (R-2, R-3, R-4, R-5, and S-4) during two consecutive sampling events, and for the remaining site wells (W-1, W-2, W-10, I-2, I-4, I-5, L-1, L-5, and R-1), or some subset of these wells agreed upon by U.S. EPA and AHP, for two consecutive sampling events. Within 30 days of validation of this data, AHP must submit the validated data in a report to the U.S. EPA (see 3.3 below). Upon U.S. EPA approval of the report, AHP may enter the performance monitoring period (see 3.2 below).

b) If five years after the installation of the AS/SVE system, groundwater performance standards are not met, the concentrations in the compliance wells have reached steady-state levels (i.e., the groundwater concentrations remain constant within ±10% over a 1-year period, or as approved by U.S. EPA), and the soil and groundwater remediation systems have been operated in accordance with the approved O&M Plan[1], AHP has the option at any time to *reevaluate the relevant points of compliance or the groundwater performance standards* which have not been met and/or evaluate alternative corrective measures for the groundwater remediation area (U.S. EPA, 1988, U.S. EPA, 1993, U.S. EPA, 1999, and/or other applicable guidance in effect at the time). AHP may submit a document to U.S. EPA for approval, that proposes new points of compliance, new groundwater performance standards, and/or alternative corrective measures as necessary to protect human health and the environment. The alternative corrective measures that AHP may submit include, but are not limited to the following: engineering controls, institutional controls, and monitored natural attenuation. U.S. EPA will approve or disapprove AHP's proposal based on criteria provided in applicable U.S. EPA regulations and/or guidance in effect at the time.

3.2 Groundwater Monitoring Program

Paragraph 15 in the AOC requires the implementation of a groundwater monitoring program to monitor the shallow and bedrock aquifers at the facility. The goal of this program is to monitor the progress of groundwater remediation and establish the basis to determine its completion.

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[1] Minor or infrequent deviations from the requirements of the approved O&M Plan will not preclude AHP from pursuing this option provided U.S. EPA agrees that the deviations do not have a negative impact on the operation of the soil and groundwater remediation systems.

The monitoring wells that AHP will sample as part of the groundwater monitoring program are classified into three categories: compliance wells, assessment wells, and background wells. Compliance wells are used as "compliance points." "For final cleanups selected to return groundwater to its maximum beneficial use, EPA recommends regulators set the point of compliance throughout the area of contaminated groundwater, or when waste is left in place, at and beyond the boundary of the waste management area encompassing the original sources of groundwater contamination...." (footnote omitted) (U.S. EPA, 2001). The compliance wells will be used to compare groundwater contaminant concentrations to the groundwater performance standards to determine if remediation is complete. Assessment wells will be used to assess groundwater remediation system progress and to determine if changes are needed in recovery well pumping rates, air sparging flow rates, and pulse pumping schedules. The background well will be used to monitor background (upgradient) conditions. The compliance, assessment, and background wells to be used in the groundwater monitoring program (see Figure 2) are:

- Shallow zone: well L-3 (background), wells L-5 and AS-1 (assessment), well S-4 (compliance).
- Bedrock zone: wells R-2, R-3, R-4 and R-5 (compliance).
- Bedrock zone production/recovery wells: wells W-1 and W-10 (assessment).

The *groundwater monitoring program* consists of the following: all compliance wells, all assessment wells, and the background well[2]. AHP will analyze samples from all compliance wells, all assessment wells, and the background well for the following site-specific target compounds as required by this Scope of Work:

Site Specific Target Compound	Groundwater Performance Standard (µg/l)
1,1-dichloroethane	810
1,1-dichloroethylene	7
cis-1,2-dichloroethylene	70
trans-1,2-dichloroethylene	100
1,1,1-trichlorethane	200
trichloroethylene	5
vinyl chloride	2

[2] In addition, AHP will sample the following site wells (W-1, W-2, W-10, I-2, I-4, I-5, L-1, L-5, and R-1), or some subset of these wells agreed upon by the U.S. EPA and AHP, for two consecutive quarterly sampling events to show no groundwater performance standards are exceeded before AHP discontinues operation of the groundwater pump and treat system (see 3.1a).

AHP will sample all compliance wells, all assessment wells, and the background well quarterly starting 90 days after the effective date of the AOC. However, AHP reserves the right to petition U.S. EPA to reduce the number of wells sampled, the frequency of sampling, and/or the constituents being sampled for during and after the first five year period if performance of the activities that are the subject of the petition are not necessary to protect human health or the environment. At a minimum, after five years of quarterly monitoring, the groundwater sampling schedule for all wells will be reduced to semi-annual.

If at any time during the sampling program, AHP questions groundwater sampling data from any of the compliance wells, AHP will initiate a discussion with U.S. EPA to determine an appropriate course of action. This course of action may include the resampling of one or more of the wells and resubmitting the new data in replacement of the previously collected data.

The *groundwater pump and treat system performance-monitoring period* begins after the groundwater pump and treat system is no longer required to operate (see 3.1). The performance-monitoring period consists of semi-annual groundwater sampling of all compliance wells, bedrock zone production/recovery wells (W-1 and W-10), and the background well for two years. At the conclusion of each semi-annual performance monitoring period, and within 30 days of the validation of the data obtained during that monitoring period, AHP will submit the validated data in a report to the U.S. EPA (see 3.3 below). If no groundwater performance standards are exceeded during the performance monitoring period, then AHP may terminate the performance monitoring program and must submit the groundwater remediation and monitoring report required under Section 3.3 below.

If *one or more of the groundwater performance standards above is exceeded* in any of the wells sampled during the performance monitoring period, AHP will initiate a discussion with the U.S. EPA to determine an appropriate course of action. This course of action may include additional operation of the groundwater pump and treat system and/or alternative corrective measures as necessary to protect human health and the environment. AHP has the option at any time to *reevaluate the relevant points of compliance or the groundwater performance standards* which have not been met and/or evaluate alternative corrective measures for the groundwater remediation area (U.S. EPA, 1988, U.S. EPA, 1993, U.S. EPA, 1999, and/or other applicable guidance in effect at the time). AHP may submit a document to U.S. EPA for approval, that proposes new points of compliance, new groundwater performance standards, and/or alternative corrective measures as necessary to protect human health and the environment. Alternative corrective measures may include, but are not limited to the following: engineering controls, institutional controls, and monitored natural attenuation. U.S. EPA will approve or disapprove AHP's proposal based on criteria provided in applicable U.S. EPA regulations and/or guidance in effect at the time.

3.3 Groundwater Remediation Reporting

AHP must submit the following reports to U.S. EPA:

a) Within 30 days after AHP determines that, based on validated site data, the groundwater performance standards have been attained at the facility, *AHP must submit a written report* to U.S. EPA for review and approval. This report must include a description of the performance monitoring to be performed to ensure that groundwater performance standards continue to be attained after the groundwater pump and treat system is no longer required to operate.

b) Within 30 days after the performance monitoring period has ended and AHP has validated site data, *AHP must submit a written report* to U.S. EPA for review and approval. In the report, a registered professional engineer or geologist and AHP's Project Manager must state that the groundwater performance standards have been attained at the point of compliance in satisfaction of requirements of the AOC, to the best of their knowledge, or that AHP has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA.

AHP must revise and resubmit both reports in response to U.S. EPA's written comments, if any, within 30 days of receipt of the comments from U.S. EPA, or under such other extended schedule as may be approved by U.S. EPA.

If U.S. EPA approves the report set forth in Paragraph 3.3b above and there have been no exceedances of groundwater performance standards during the performance monitoring period (or if AHP has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA), AHP may discontinue operating the groundwater pump and treat system, and the groundwater sampling and reporting program, and AHP will have satisfied all groundwater remediation requirements of the AOC.

3.4 Air Sparging System

This section discusses the following aspects of the AOC groundwater air sparging system:

- Groundwater Air Sparging Completion
- Groundwater Air Sparging Reporting

3.4.1 Groundwater Air Sparging Completion

AHP will conduct groundwater air sparging in Area 3-East (see Figure 1) and will sample air sparging assessment well AS-1 as part of the groundwater monitoring program described in Section 3.2. AHP may discontinue operating the groundwater air sparging system and the groundwater sampling of well AS-1 based on the following process:

a) *AHP may discontinue operating the groundwater air sparging system* once the sampling data from the groundwater monitoring program show that no groundwater performance standards (see 3.2) are exceeded for the air sparging assessment well AS-1 during two consecutive sampling events. Within 30 days of the validation of this data, AHP will submit the validated data in a report to the U.S. EPA (see 3.4.2 below) and enter a performance monitoring period (see 3.4.1c below).

b) If five years after the effective date of the AOC, the groundwater performance standards are not met in well AS-1, the concentrations have reached steady-state levels (the groundwater concentrations remain constant within ±10% over a 1-year period, or as approved by U.S. EPA), and the air sparging system has been operated in accordance with the approved O&M Plan[3], AHP has the option at any time to *reevaluate the groundwater performance standards* which have not been met and/or evaluate alternative corrective measures for the air sparging area (U.S. EPA 1988, U.S. EPA, 1993, and/or other applicable guidance in effect at the time). AHP may submit a document to U.S. EPA for approval, that proposes new groundwater performance standards and/or alternative corrective measures as necessary to protect human health and the environment. The alternative corrective measures that AHP may submit include, but are not limited to the following: engineering controls, institutional controls, and monitored natural attenuation. U.S. EPA will approve or disapprove AHP's proposal based on criteria provided in applicable U.S. EPA regulations and/or guidance in effect at the time.

c) The *air sparging performance-monitoring period* will start after the air sparging system is no longer required to operate (see 3.4.1a). The performance-monitoring period will consist of quarterly groundwater sampling of the assessment well AS-1 (see 3.2) for two years. At the conclusion of the performance monitoring period, and within 30 days of the validation of this data, AHP will submit the validated data in a report to U.S. EPA (see 3.4.2 below).

d) If *any of the groundwater performance standards* (listed in 3.2) are exceeded in well AS-1 during the performance monitoring period (see 3.4.1c), AHP will initiate a discussion with the U.S. EPA to determine an appropriate course of action. This course of action may include additional operation of the groundwater air sparging system and/or alternative corrective measures as necessary to protect human health and the environment. AHP may submit a document to U.S. EPA for approval, that proposes new groundwater performance standards and/or alternative corrective measures as necessary to protect human health and the environment. Alternative corrective measures may include, but are not limited to the following: engineering controls, institutional controls, and monitored natural attenuation. U.S. EPA will approve or disapprove AHP's proposal based on criteria provided in applicable U.S. EPA regulations and/or guidance in effect at the time.

3.4.2 Groundwater Air Sparging Reporting

AHP must submit the following reports to U.S. EPA:

a) Within 30 days after AHP determines that, based on validated site data, the groundwater performance standards have been attained in well AS-1 (see 3.4.1a), *AHP must submit a written report* to U.S. EPA for review and approval. This report must include a description of the performance monitoring to be performed to ensure that groundwater performance standards

---

[3] Minor or infrequent deviations from the requirements of the approved O&M Plan will not preclude AHP from pursuing this option provided U.S. EPA agrees that the deviations do not have a negative impact on the operation of the soil and groundwater remediation systems.

continue to be attained after the air sparging system is no longer required to operate.

b) Within 30 days after the performance monitoring period has ended and AHP has validated site data, *AHP must submit a written report* to U.S. EPA for review and approval. In this report, a registered professional engineer or geologist and AHP's Project Manager must state that the groundwater performance standards have been attained in well AS-1 in full satisfaction of requirements of the AOC, to the best of their knowledge, or that AHP has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA.

AHP must revise and resubmit both reports in response to U.S. EPA's written comments, if any, within 30 days of receipt of the comments from U.S. EPA, or under such other extended schedule as may be approved by U.S. EPA.

If U.S. EPA approves the demonstration set forth in Paragraph 3.4.1a and there have been no exceedances of groundwater performance standards during the performance monitoring period (or if AHP has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA), AHP may discontinue operating the groundwater air sparging system, the groundwater sampling of well AS-1 and reporting, and AHP will have satisfied the groundwater air sparging remediation requirements of the AOC.

4.0 Soil Remediation

This section discusses the following aspects of the AOC soil remediation:

- Soil Corrective Measures Alternatives
- Soil Monitoring Program
- Soil Remediation Reporting

4.1 Soil Corrective Measure Alternatives

The soil remediation program consists of conducting SVE in three areas outside the building (CMS Alternative OS-3) and one area inside the building (CMS Alternative IS-2). AHP will operate the soil remediation system continuously except for periodic maintenance activities. AHP will describe the required operation and maintenance procedures for the soil remediation system in the U.S. EPA-approved Operations and Maintenance (O&M) Plan. The soil remediation system operations will be recorded either daily by WKI on-site maintenance personnel, or automatically with electronic data loggers. AHP will document the O&M activities and total operation time in the progress reports.

Soil Remediation Completion: The soil remediation in any given area will be complete and AHP may discontinue operating the soil remediation program based on the following process:

a) AHP will operate each of the SVE systems until it reaches a *negligible removal rate*, which is defined as an extracted air target-compound removal rate less than 0.2 lb/day for two

consecutive months or the removal rate remains within a narrowly defined range (AHP will provide a specific proposal to U.S. EPA for approval to define this range) for four consecutive months. At this point, AHP will initiate soil confirmation sampling (see 4.2 below).

b) If *soil confirmation sampling* does not confirm that the soil performance standards have been met (see 4.2), then AHP has the option to *reevaluate the soil performance standards and/or to evaluate other corrective measures* in those areas where the designated soil performance standards have not been met. AHP may submit a document to U.S. EPA for approval, that proposes new soil performance standards and/or alternative corrective measures as necessary to protect human health and the environment. The alternative corrective measures that AHP may submit include, but are not limited to, engineering controls. U.S. EPA will approve or disapprove AHP's proposal based on criteria provided in applicable U.S. EPA regulations and/or guidance in effect at the time.

c) The *soil remediation will be complete* in any of the SVE remediation areas when the soil confirmation sampling results are below all of the designated performance standards (see 4.2), or as otherwise approved by U.S. EPA.

d) The *soil remediation will continue* in any of the SVE remediation areas when any of the soil confirmation sampling results are above the designated performance standards (see 4.2). In these areas, SVE remediation will continue with subsequent soil confirmation sampling (see 4.2) until sample results in the area are all below the performance standards or until otherwise approved by U.S. EPA. AHP may submit a document to U.S. EPA for approval, that proposes new soil performance standards and/or alternative corrective measures as necessary to protect human health and the environment. The alternative corrective measures that AHP may submit include, but are not limited to, engineering controls. U.S. EPA will approve or disapprove AHP's proposal based on criteria provided in applicable U.S. EPA regulations and/or guidance in effect at the time.

4.2 Soil Monitoring Program

The soil remediation monitoring will consist of monitoring air from the SVE vents and collecting confirmation soil samples from the SVE remediation areas. During the SVE system operation, AHP will collect air samples and flow measurements from the SVE system air emissions in each of the remediation areas. AHP will analyze the air samples for the four target constituents listed below. These data will be used to evaluate system performance, maintenance, optimization, and termination. The point of compliance for the soil performance standards is at any points necessary to protect against exceedances of the soil performance standards for protecting groundwater in the table below.

Soil confirmation sampling will consist of advancing three soil borings spaced evenly throughout each SVE remediation area and collecting two soil samples from each soil boring: one from the midpoint which is defined as halfway between ground surface and the bottom of the deepest SVE well in that area; and one from the soil interval with the maximum photoionization detector

(PID) screening level. AHP will analyze the samples for the following site-specific target compounds to determine compliance with their respective soil performance standard:

Site-Specific Target Compound	Soil Performance Standard (µg/kg)
1,1-dichloroethylene	120
1,2-dichloroethylene	1500
1,1,1-trichloroethane	6140
trichloroethylene	230

If during *soil confirmation sampling*, soil data from any of the samples are questioned, AHP will initiate a discussion with U.S. EPA to determine an appropriate course of action. This course of action may include resampling of one or more of the areas and resubmitting the new data in replacement of the previously collected data.

4.3 Soil Remediation Reporting

Within 30 days after determining that the soil remediation is complete, *AHP must submit a written report* to U.S. EPA for review and approval. A registered professional engineer or geologist and AHP's Project Manager must state in the report that the soil performance standards were attained in all SVE areas in full satisfaction of requirements of the AOC, to the best of their knowledge, or that AHP has attained alternative soil performance standards and/or alternative corrective measures approved by U.S. EPA. AHP must revise and resubmit the report in response to U.S. EPA's written comments, if any, within 30 days of receipt of the comments from U.S. EPA, or under such other extended schedule as approved by U.S. EPA. If U.S EPA approves the demonstration set forth in Paragraph 4.2 above and all soil confirmation samples are below the soil performance standards (or if AHP has fully attained alternative performance standards and/or corrective measures approved by U.S. EPA), AHP may discontinue conducting soil remediation, sampling, maintenance, and reporting activities required under the AOC, and AHP will have satisfied all soil remediation requirements of the AOC.

5. References

U.S. EPA. 1988. *Alternate Concentration Limit Guidance.* Office of Solid Waste and Emergency Response. Washington, D.C. EPA/530-SW-87-031.

U.S. EPA. 1993. *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration.* Office of Solid Waste and Emergency Response. Washington, D.C. OSWER Directive 9234.2-25.

U.S. EPA. 1998. *RCRA Quality Assurance Project Plan (QAPP) Instructions.* Region 5. Waste, Pesticides and Toxics Division. Chicago, Illinois.

U.S. EPA. 1999. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.* Office of Solid Waste and Emergency Response. Washington, D.C. OSWER Directive 9200.4-17P.

U.S. EPA. 2000. *Use of Institutional Controls in the RCRA Corrective Action Program.* Region 5. Waste, Pesticides and Toxics Division. Chicago, Illinois.

U.S. EPA. 2001. *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action.* Office of Solid Waste and Emergency Response. Washington, D.C. EPA/530/R-01/015.

WESTON. 1993. "Final Corrective Measures Study, EKCO Housewares, Inc., Massillon, Ohio."

WESTON. 1994. "Addendum to the Corrective Measures Study, EKCO Housewares, Inc., Massillon, Ohio."

WESTON. 2001. "Final Soil Investigation Report for the EKCO WKI Facility, Massillon, Ohio."

Table 1. Administrative Order on Consent Schedule
WKI, Massillon, Ohio Facility

Event	Due Date*
American Home Products Corporation and U.S. EPA must each designate a Project Manager and notify each other in writing.	14 days
Submit a Community Relations Plan.	45 days
Submit an Institutional Control Plan.	45 days
Submit a Project Management Plan.	45 days
Submit a Data Management Plan.	45 days
Submit a Sampling and Analysis Plan.	60 days
Submit a Quality Assurance Project Plan.	60 days
Submit a Site Health and Safety Plan.	60 days
Submit first Progress Report and submit quarterly thereafter**.	60 days
Begin quarterly groundwater monitoring program for first 5 years and semi-annually thereafter.**	90 days
Submit a Design Report for implementing IS-2, OS-3, and GW-6.	90 days
Complete construction and begin operation of IS-2, OS-3, and GW-6.	12 months
Submit a Construction Completion Report and Operation and Maintenance Plan for IS-2, OS-3, and GW-6.	15 months

* Due date is the time from the effective date of the AOC.
** Or other schedule as approved by U.S. EPA.

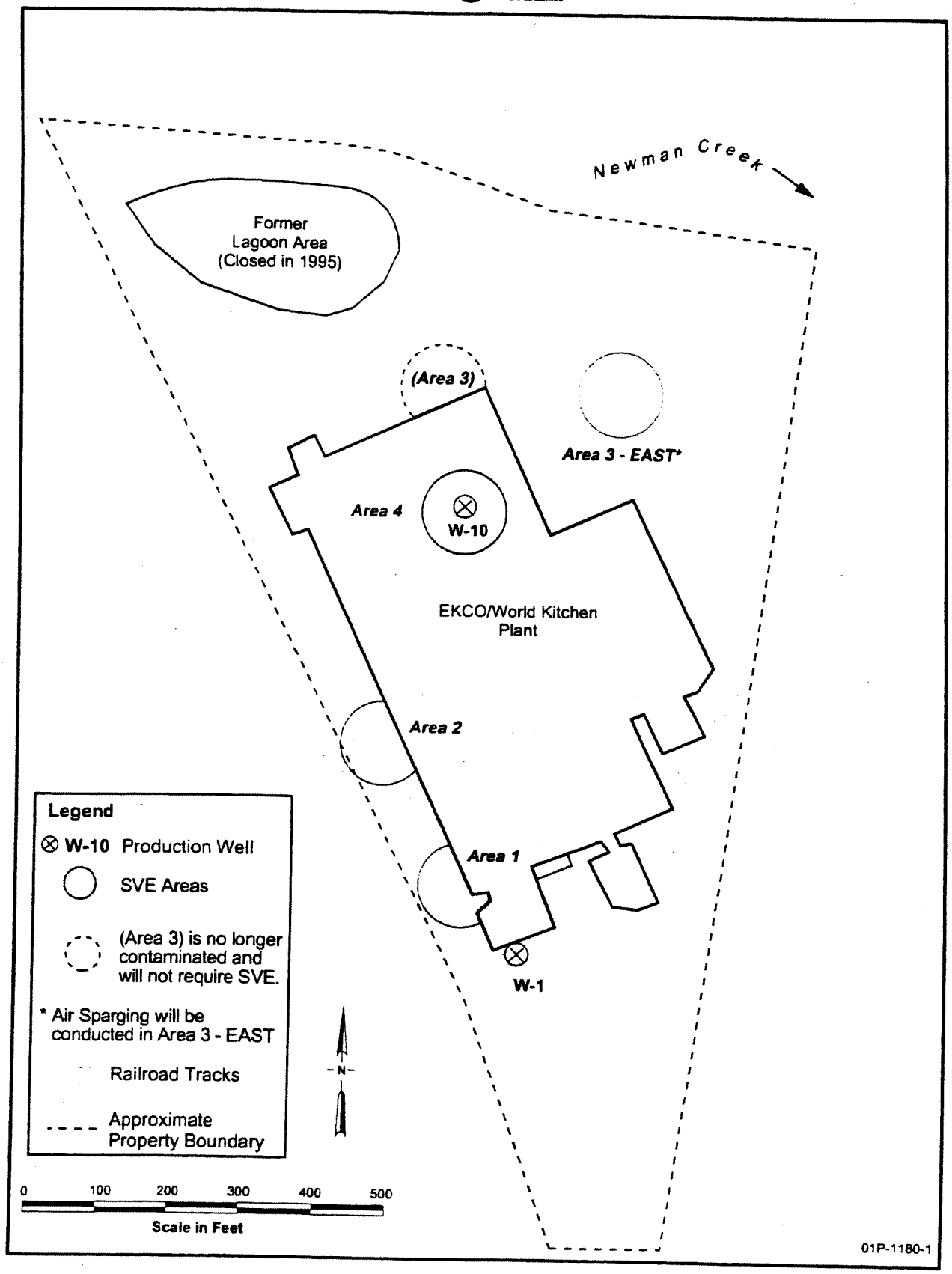

FIGURE 1 SOIL VAPOR EXTRACTION (SVE) AND AIR SPARGING AREAS

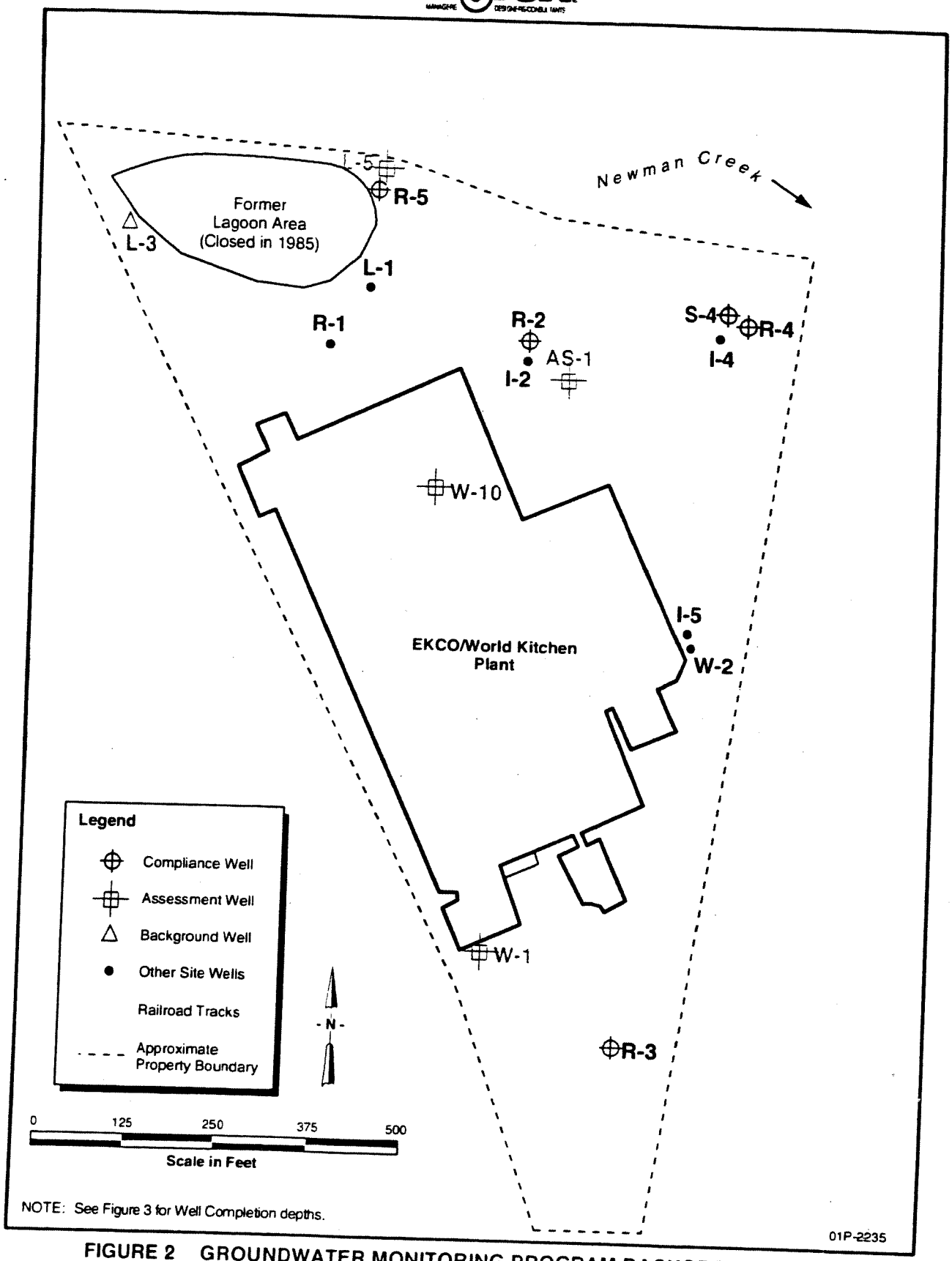

FIGURE 2 GROUNDWATER MONITORING PROGRAM BACKGROUND, ASSESSMENT, AND COMPLIANCE WELLS

IN THE MATTER OF:
World Kitchen, Inc.
359 State Avenue, Ext. N.W.
Massillon, Ohio 44648-0560
OHD 045 205 424

DOCKET NO. RCRA-05- 2002-0010

CERTIFICATE OF SERVICE

I hereby certify that today I have filed the original of this Administrative Order on Consent and this Certificate of Service in the Office of the Regional Hearing Clerk (E-19J), United States Environmental Protection Agency, Region 5, 77 W. Jackson Boulevard, Chicago, IL 60604-3590.

I further certify that I then caused true and correct copies of the filed document to be mailed to the following:

Ms. Geraldine Smith, Esq.
American Home Products Corporation
Five Giralda Farms
Madison, NJ 07940
Certified Mail #7099 3400 0000 9585 3970

Ms. Keely J. O'Bryan, Esq.
Thompson Hine
3900 Key Center
127 Public Square
Cleveland, Ohio 44114-1291
Certified Mail #7099 3400 0000 9585 4038

Dated: 22 August 2002

Mary Ann Stephen
Administrative Program Assistant
Enforcement and Compliance
Assurance Branch
United States Environmental
Protection Agency
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590
(312) 886-4435

US ENVIRONMENTAL PROTECTION AGENCY REGION V

'02 AUG 22 P1:46

REGIONAL HEARING CLERK

Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380
610-701-3000 • Fax 610-701-3186
www.westonsolutions.com

23 October 2002

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 2
Revised Pages for Volume 1

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached 2 copies of the Consent Order Plans and Reports (COPR), Volume 2. The plans provided in Volume 2 include:

- Quality Assurance Project Plan (QAPP)
- Sampling and Analysis Plan (SAP)
- Health and Safety Plan (HASP)

Two copies of the COPR, Volume 1, were submitted to the U.S. EPA on 9 October 2002. The plans that were provided in Volume 1 included:

- Project Management Plan (PMP)
- Data Management Plan (DMP)
- Community Relations Plan (CRP)
- Institutional Control Plan (ICP)

The submission of Volumes 1 and 2 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b, Section VI, Paragraph 15; and Section 2 and Table 1 of Attachment 2 of the Consent Order. The remaining plans and reports will be submitted to the U.S. EPA in subsequent volumes.

Weston Solutions, Inc. (WESTON®) received comments on the COPR, Volume 1, from the U.S. EPA on 21 October 2002. Two copies of responses to the comments and revised pages for the COPR, Volume 1, are attached to this letter. These revised pages replace the original pages of the respective plans.

If you have any questions or comments regarding this submittal, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas S. Cornuet

Thomas S. Cornuet
Project Manager

Attachment

cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON

SITE HEALTH AND SAFETY PLAN
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

October 2002

Prepared for

WYETH
Florham Park, New Jersey

Prepared by

Weston Solutions, Inc.
1400 Weston Way
West Chester, Pennsylvania 19380

W.O. No. 02994.002.009

SITE HEALTH AND SAFETY PLAN (HASP)-FORM 1

Prepared by: Greg Flasinski	**W.O. Number:** **02994.002.009.0003** **Date:** 10/10/02
Project Identification Office: West Chester, PA Site Name: World Kitchen Client: Wyeth Work Location Address: 359 State St Ext.	**Site History:** 1945 began making bakeware, 1967 used porcelain and Teflon coating, currently plant continues to manufacture pressed and coated nonstick bakeware. Massillon, OH 44648

Scope of Work: Groundwater Sampling, Soil Boring/Well Installation, Soil Vapor Extraction (SVE) system installation and sampling , monitor well extraction well and air stripper maintenance activities.

☐ Sites visit only; site HASP not necessary. List personnel here and sign off below:

Regulatory Status:

Site regulatory status:

CERCLA/SARA	RCRA	Other Federal Agency
☐ U.S. EPA	X U.S. EPA	☐ DOE
☐ State	State	☐ USACE
☐ NPL Site	NRC	☐ Air Force
☐ OSHA	☐ 10 CFR 20	☐ _____

Hazard Communication (Req'd See Attachment D)
☐ 1910 ☐ 1926 ☐ State

Safety Officer Manual (Required to be On-Site)
Based on the Hazard Assessment and Regulatory Status, determine the Standard HASP(s) applicable to this project. Indicate below which Standard HASP will be used and append the appropriate pages of this form along with the Standard Plan.

☐ Stack Test	☐ _____
☐ Air Emissions	☐ _____
☐ Asbestos	☐ _____
☐ Industrial Hygiene	☐ _____
☐ _____	☐ _____

Review and Approval Documentation:

Reviewed by:
SO/DSM/CHS — Robert Massengill (Name (Print)) — Signature — Date: 10-16-02

Other — Name (Print) — Signature — Date: _____

Approved by:
Project Manager — Thomas Cornuet (Name (Print)) — Signature — Date: 10-16-02

Hazard Assessment and Equipment Selection:

In accordance with WESTON's Personal Protective Equipment Program and 29 CFR 1910.132, at the site prior to personnel beginning work, the SHSC and/or the Site Manager have evaluated conditions and verified that the personal protective equipment selection outlined within this HASP is appropriate for the hazards known or expected to exist. (Refer to Safety Officer Manual Section 2, Personal Protection Program, for guidance.)

☒ SHSC Site Manager — Dave Cairns (Name (Print)) — Signature — Date: 10/23/02

Project start date: 11/01/02 End date: 12/31/03	This site HASP **must** be **reissued/reapproved** for any activities conducted after: Date: 12/31/03	Amendment date(s) By: 1. 2. 3. 4. 5.

WESTON REPRESENTATIVES-FORM 2

Organization/Branch	Name/Title	Address	Telephone
Geosciences	Greg Flasinski	1410 Weston Way West Chester, PA 19380	610.701.7293
Geosciences	Dave Cairns	1410 Weston Wa y West Chester, PA 19380	610.701.7255
Geosciences	Bill Westley	3149 Copley Rd. Copley, OH 44321	(330)666-5147

Roles and Responsibilities:

WESTON SUBCONTRACTORS

Organization/Branch	Name/Title	Address	Telephone

Roles and Responsibilities:

SITE-SPECIFIC HEALTH AND SAFETY PERSONNEL

The Site Health and Safety Coordinator (SHSC) for activities to be conducted at this site is: Dave Cairns

The SHSC has total responsibility for ensuring that the provisions of this Site HASP are adequate and implemented in the field.

Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as SHSCs are experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120.

Qualifications:

- 40 Hour OSHA trained
- 1st Aid /CPR Trained
- 8 hour yearly refresher training
- 8 hour site safety coordinator training
- Bloodborne Pathogen Course

Designated alternates include: Bill Westley

Revised 2/1998

HEALTH AND SAFETY EVALUATION-FORM 3

Hazard Assessment

Background Review: X Complete ☐ Partial If partial why?

Activities Covered Under This Plan:

No.	Task/Subtask	Description	Schedule
1	0200	Groundwater Sampling	ONGOING
2	0500	Soil Boring / Well Installation	11/02→
3	0600	Well Maintenance	11/02 →
4	0700	SVE Installation	11/02→

Types of Hazards:

1 Numbers refer to one of the following hazard evaluation forms. Complete hazard evaluation forms for each appropriate hazard class.

Physiochemical 1

- ☐ Flammable
- ☐ Explosive
- ☐ Corrosive
- ☐ Reactive
- ☐ O_2 Rich
- ☐ O_2 Deficient

Chemically Toxic 1

- ☒ Inhalation
- X Ingestion
- X Contact
- X Absorption
- X Carcinogen
- ☐ Mutagen
- ☐ Teratogen

☐ OSHA 1910.1000 Substance (Air Contaminants)

☐ OSHA Specific Hazard Substance Standard (Refer to following page for listing)

Radiation 3

Ionizing:

- ☐ Internal exposure
- ☐ External exposure

Non-ionizing:

- ☐ UV
- ☐ IR
- ☐ RF
- ☐ MicroW
- ☐ Laser

Biological 2

- ☐ Etiological Agent
- ☒ Other (plant, insect, animal)

☐ **Physical Hazards 4**

X Construction Activities

Source/Location of Contaminants and Hazardous Substances:

Directly Related to Tasks

- ☐ Air
- ☐ Other Surface
- X Groundwater
- X Soil
- ☐ Surface Water
- ☐ Sanitary Wastewater
- ☐ Process Wastewater
- ☐ Other _____

Indirectly Related to Tasks — Nearby Process(es) That Could Affect Team Members:

- ☒ Client Facility/WESTON Work Location
- ☐ Nearby Non-Client Facility

Describe:

☐ Have activities (task[s]) been coordinated with facility?

Revised 02/1998

HEALTH AND SAFETY EVALUATION-CHEMICAL HAZARDS OF CONCERN-FORM 4

☐ N/A

Chemical Contaminants of Concern

Provide the data requested for chemical contaminants on HASP Form 25 or attach data sheets from an acceptable source such as NIOSH pocket guide, condensed chemical dictionary, ACGIH TLV booklet, etc. List chemicals and concentrations below and locate data sheets in Attachment B of this HASP.

Chemical Name	Concentration (if known)
Trichloroethene	200 ppb
1,1 Dichloroethane	50 ppb
1,1 Dichloroethene	50 ppb
Vinyl Chloride	5 ppb
1,1,1 Trichloroethane	500 ppb

☐ N/A

Identify hazardous materials used or on-site and attach Material Safety Data Sheets (MSDSs) for all reagent type chemicals, solutions, or other identified materials that in normal use in performing tasks related to this project could produce hazardous substances. Ensure that all subcontractors and other parties working nearby are informed of the presence of these chemicals and the location of the MSDSs. Obtain from subcontractors and other parties, lists of the hazardous materials they use or have on-site and identify location of the MSDSs here. List chemicals and quantities below and locate MSDSs in Attachment B of this HASP.

Chemical Name	Quantity
Liquinox	1 Liter

OSHA-SPECIFIC HAZARDOUS SUBSTANCES

The following substances may require specific medical, training, or monitoring based on concentration or evaluation of risk. See the appropriate citation listed under 29 CFR 1910 or 1926 for additional information.

- ☐ 1910.1001 Asbestos
- ☐ 1910.1002 Coal tar pitch volatiles
- ☐ 1910.1003 4-Nitrobiphenyl, etc.
- ☐ 1910.1004 alpha-Naphthylamine
- ☐ 1910.1005 [Reserved]
- ☐ 1910.1006 Methyl chloromethyl ether
- ☐ 1910.1007 3,3'-Dichlorobenzidine (and its salts)
- ☐ 1910.1008 bis-Chloromethyl ether
- ☐ 1910.1009 beta-Naphthylamine
- ☐ 1910.1010 Benzidine
- ☐ 1910.1011 4-Aminodiphenyl
- ☐ 1910.1012 Ethyleneimine
- ☐ 1910.1013 beta-Propiolactone
- ☐ 1910.1014 2-Acetylaminofluorene
- ☐ 1910.1015 4-Dimethylaminoazobenzene
- ☐ 1910.1016 N-Nitrosodimethylamine
- ☐ 1910.1017 Vinyl chloride
- ☐ 1910.1018 Inorganic arsenic
- ☐ 1910.1025 Lead (Att. FLD# 46)
- ☐ 1910.1027 Cadmium
- ☐ 1910.1028 Benzene
- ☐ 1910.1029 Coke oven emissions
- ☐ 1910.1043 Cotton dust
- ☐ 1910.1044 1,2-Dibromo-3-chloropropane
- ☐ 1910.1045 Acrylonitrile
- ☐ 1910.1047 Ethylene oxide
- ☐ 1910.1048 Formaldehyde
- ☐ 1910.1050 Methylenedianiline
- ☐ 1910.1051 1,3 Butadiene
- ☐ 1910.1052 Methylene chloride

Revised 02/1998

HEALTH AND SAFETY EVALUATION-2 BIOLOGICAL HAZARDS OF CONCERN-FORM 5

X **Poisonous Plants** (FLD 43) Location/Task No(s).: Source: x Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion x Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☒ No Immunization required: ☐ Yes ☒ No	X **Insects** (FLD 43) Location/Task No(s).: Source: x Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion x Contact ☒ Direct Penetration Team Member(s) Allergic: ☐ Yes ☒ No Immunization required: ☐ Yes ☒ No
Snakes, Reptiles (FLD 43) Location/Task No(s).: Source: x Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion x Contact ☒ Direct Penetration Team Member(s) Allergic: ☐ Yes ☒ No Immunization required: ☐ Yes ☒ No	X **Animals** (FLD 43) Location/Task No(s).: Source: X Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☒ Direct Penetration Team Member(s) Allergic: ☐ Yes ☒ No Immunization required: ☐ Yes ☒ No
FLD 43 — WESTON Biohazard Field Operating Procedures: Att. OP ☐	
☐ **Sewage** Location/Task No(s).: Source: ☐ Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☐ No Immunization required: ☐ Yes ☐ No Tetanus Vaccination within Past 10 yrs: ☐ Yes ☐ No	☐ **Etiologic Agents (List)** Location/Task No(s).: Source: ☐ Known ☐ Suspect Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration Team Member(s) Allergic: ☐ Yes ☐ No Immunization required: ☐ Yes ☐ No
FLD 44 — WESTON Bloodborne Pathogens Exposure Control Plan – First Aid Procedures: Att. OP X	
FLD 45 — WESTON Bloodborne Pathogens Exposure Control Plan – Working with Infectious Waste: Att. OP ☐	

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HEALTH AND SAFETY EVALUATION-4 PHYSICAL HAZARDS OF CONCERN-FORM 7

Phy. Haz. Cond.	Physical Hazard	Attach OP	WESTON OP Titles
Loud noise	Hearing loss/disruption of communication	X	FLD01 - Noise Protection
Inclement weather	Rain/humidity/cold/ice/snow/lightning	X	FLD02 - Inclement Weather
Steam heat stress	Burns/displaced oxygen/wet working surfaces		FLD03 - Hot Process - Steam
Heat stress	Burns/hot surfaces/low pressure steam		FLD04 - Hot Process - LT3
Ambient heat stress	Heat rash/cramps/exhaustion/heat stroke	X	FLD05 - Heat Stress Prevention/Monitoring
Cold stress	Hypothermia/frostbite	X	FLD06 - Cold Stress
Cold/wet	Trench/paddy/immersion foot/edema	X	FLD07 - Wet Feet
Confined spaces	Falls/burns/drowning/engulfment/electrocution	☐	FLD08 - Confined Space Entry
Explosive vapors	Thermal burns/impaction/dismemberment	☐	FLD09 - Hot Work
Improper lifting	Back strain/abdomen/arm/leg muscle/joint injury	X	FLD10 - Manual Lifting/Handling Heavy Objects
Uneven surfaces	Vehicle accidents/slips/trips/falls	☐	FLD11 - Rough Terrain
Poor housekeeping	Slips/trips/falls/punctures/cuts/fires	X	FLD12 - Housekeeping
Structural integrity	Crushing/overhead hazards/compromised floors	☐	FLD13 - Structural Integrity
Hostile persons	Bodily injury	☐	FLD14 - Site Security
Remote area	Slips/trips/falls/back strain/communication	☐	FLD15 - Remote Area
Improper cyl. handling	Mechanical injury/fire/explosion/suffocation	☐	FLD16 - Pressure Systems - Compressed Gases
Water hazards	Poor visibility/entanglement/drowning/cold stress	☐	FLD17 - Diving
Water hazards	Drowning/heat/cold stress/hypothermia/falls	☐	FLD18 - Operation and Use of Boats
Water hazards	Drowning/frostbite/hypothermia/falls/electrocution	☐	FLD19 - Working Over Water
Vehicle hazards	Struck by vehicle/collision	☐	FLD20 - Traffic
Explosions	Explosion/fire/thermal burns	☐	FLD21 - Explosives
Moving mechanical parts	Crushing/pinch points/overhead hazards/electrocution	☒	FLD22 - Heavy Equipment Operation
Moving mech. parts	Overhead hazards/electrocution	☐	FLD23 - Cranes/Lifting Equipment Operation
Working at elevation	Overhead hazards/falls/electrocution	☒	FLD24 - Aerial Lifts/Manlifts
Working at elevation	Overhead hazards/falls/electrocution	☐	FLD25 - Working at Elevation
Working at elevation	Overhead hazards/falls/electrocution/slips	☐	FLD26 - Ladders
Working at elevation	Slips/trips/falls/overhead hazards	☐	FLD27 - Scaffolding
Trench cave-in	Crushing/falling/overhead hazards/suffocation	☐	FLD28 - Excavating/Trenching
Improper material handling	Back injury/crushing from load shifts	☐	FLD29 - Materials Handling
Physiochemical	Explosions/fires from oxidizing, flam./corr. material	☐	FLD30 - Hazardous Materials Use/Storage
Physiochemical	Fire and explosion	☐	FLD31 - Fire Prevention/Response Plan Required
Physiochemical	Fire	☒	FLD32 - Fire Extinguishers Required
Structural integrity	Overhead/electrocution/slips/trips/falls/fire	☐	FLD33 - Demolition
Electrical	Electrocution/shock/thermal burns	☒	FLD34 - Utilities
Electrical	Electrocution/shock/thermal burns	X	FLD35 - Electrical Safety
Burns/fires	Heat stress/fires/burns	☒	FLD36 - Welding/Cutting/Burning
Impact/thermal	Thermal burns/high pressure impaction/heat stress	☐	FLD37 - High Pressure Washers
Impaction/electrical	Smashing body parts/pinching/cuts/electrocution	☒	FLD38 - Hand and Power Tools
Poor visibility	Slips/trips/falls	☐	FLD39 - Illumination
Fire/explosion	Burns/impaction	☐	FLD40 - Storage Tank Removal/Decommissioning
Communications	Disruption of communications	☐	FLD41 - Std. Hand/Emergency Signals
Energy/release	Unexpected release of energy	☐	FLD42 - Lockout/Tagout
Logging/ground clearing/grubbing activities	Operations associated with felling/moving of trees/brush/logs	☒	FLD47 - Clearing, Grubbing, and Logging Operations
Drilling hazards	Electrocution/overhead hazards/pinch points	X	1.6 - Drilling Safety Guide

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TASK-BY-TASK RISK ASSESSMENT-FORM 8

(COMPLETE ONE SHEET FOR EACH TASK)

TASK DESCRIPTION

Task 1 - Groundwater Sampling

EQUIPMENT REQUIRED/USED

(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Submersible Pumps, Generator, Bailers

POTENTIAL HAZARDS/RISKS

Chemical

X Hazard Present Risk Level: ☐ H ☐ M X L

What justifies risk level? Previous sample data shows levels are all close to detection limits. Years of background air monitoring readings from both the breathing zone and in the well.

Physical

X Hazard Present Risk Level: ☐ H ☐ M X L

What justifies risk level? Site is flat, mainly paved, risk of physical injury is low.

Biological

X Hazard Present Risk Level: ☐ H ☐ M X L

What justifies risk level? Site is well maintained, wells are in maintained areas

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What justifies risk level?

LEVELS OF PROTECTION/JUSTIFICATION

Modified Level "D"

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

OP's 2, 5, 6, 7, 10, 12, 32, 35, 38

TASK DESCRIPTION
Task 2 – Soil Boring / Well Installation
EQUIPMENT REQUIRED/USED **(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)**
Drill Rig, hand tools, OVM, boots, safety glasses, hardhat, no loose-fitting clothes
POTENTIAL HAZARDS/RISKS
Chemical
X Hazard Present Risk Level: ☐ H ☐ M X L What justifies risk level? Previous drilling efforts showed that there have never been elevated reading in the breathing zone. Breathing Zone will be monitored during drilling activities.
Physical
X Hazard Present Risk Level: ☐ H ☒ M L What justifies risk level? Use of drill rig. Drilling FOP used.
Biological
X Hazard Present Risk Level: ☐ H ☐ M X L What justifies risk level? Site is well maintained, wells are in maintained areas
RADIOLOGICAL
☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L What justifies risk level?
LEVELS OF PROTECTION/JUSTIFICATION
Modified Level "D"
SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED
OP's 1, 2, 5, 6, 7, 10, 12, 22, 32, 34, 35, 38, 47, 1.6

TASK DESCRIPTION
Task 3 – Well Maintenance Activties
EQUIPMENT REQUIRED/USED **(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)**
Hand tools, paint
POTENTIAL HAZARDS/RISKS
Chemical
X Hazard Present Risk Level: ☐ H ☐ M X L What justifies risk level? No intrusive activities.
Physical
X Hazard Present Risk Level: ☐ H ☐ M X L What justifies risk level? Site is flat, mainly paved, risk of physical injury is low. No physically stressful activities.
Biological
X Hazard Present Risk Level: ☐ H ☐ M X L What justifies risk level? Site is well maintained, wells are in maintained areas
RADIOLOGICAL
☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L What justifies risk level?
LEVELS OF PROTECTION/JUSTIFICATION
Modified Level "D"
SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED
OP's 2, 5, 6, 7, 12, 32, 38, 47

TASK DESCRIPTION

Task 4 – Soil Vapor Extraction system installation and sampling.

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Manlift, hand tools, power tools, Safety glasses and hearing protection must be worn inside the plant.

POTENTIAL HAZARDS/RISKS

Chemical

X Hazard Present Risk Level: ☐ H ☐ M X L

What justifies risk level? SVE boring will be done prior to installation. All work areas will be well vented prior to the start of work.

Physical

X Hazard Present Risk Level: ☐ H ☒ M L

What justifies risk level? . Physical work not stressful but, working at height.

Biological

X Hazard Present Risk Level: ☐ H ☐ M X L

What justifies risk level? Site is well maintained, wells are in maintained areas

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☐ L

What justifies risk level?

LEVELS OF PROTECTION/JUSTIFICATION

Modified Level "D"

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

OP's 1,2,5,6,7,10,12,22,24,32,34,35,38

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PERSONNEL PROTECTION PLAN-FORM 9

Engineering Controls

Describe Engineering Controls used as part of Personnel Protection Plan:

Task(s)	
1 - 4	Make sure wells and boring areas vent prior to working near them. Also block off work areas inside the facility to divert forklift traffic.

Administrative Controls

Describe Administrative Controls used as part of Personnel Protection Plan:

Task(s)	
1 - 4	Daily site safety meeting prior to work each day, outlining potential hazards

Personal Protective Equipment

Action Levels for Changing Levels of Protection. Refer to HASP Form 13, Site Air Monitoring Program—Action Levels. Define Action Levels for up or down grade for each task:

Task(s)	
1	Safety boots, nitrile surgical gloves
2	Safety boots, work gloves, safety glasses
3	Safety boots, work gloves, safety glasses
4	Safety boots, work gloves, safety glasses

DESCRIPTION OF LEVELS OF PROTECTION

Level D	Level D Modified	
Task(s):	**Task(s):**	
☐ Head	☐ Head	
☐ Eye and Face	☒ Eye and Face	
☐ Hearing	☒ Hearing	Drilling and inside the plant
☐ Arms and Legs Only	☐ Arms and Legs Only	
☐ Appropriate Work Uniform	☐ Whole Body	
☐ Hand - Gloves	☐ Apron	
☐ Foot - Safety Boots	X Hand - Gloves	
☐ Fall Protection	☒ Gloves	1 - surgical
☐ Flotation	☐ Gloves	2 - work
☐ Other	X Foot - Safety Boots	1,2
	☐ Over Boots	

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SITE OR PROJECT HAZARD MONITORING PROGRAM-FORM 11

Air Monitoring Instruments

Instrument Selection and Initial Check Record

Reporting Format: x Field Notebook ☒ Field Data Sheets* ☐ Air Monitoring Log ☐ Trip Report ☐ Other

Instrument	Task No.(s)	Number Required	Number Received	Checked Upon Receipt	Comment	Initials
☐ CGI				☐		
☐ O_2				☐		
☐ CGI/O_2				☐		
☐ CGI/O_2/tox-PPM, H_2S,H_2S/CO				☐		
☐ RAD				☐		
☐ GM (Pancake)				☐		
☐ NaI (Micro R)				☐		
☐ ZnS (Alpha Scintillator)				☐		
☐ Other _____				☐		
☐ PID				☐		
☐ HNu 10.2				☐		
☐ HNu 11.7				☐		
☐ Photovac, TMA				☐		
☐ OVM	2			☐		
☐ Other _____				☐		
☐ FID				☐		
☐ Fox 128				☐		
☐ Heath, AID, Other				☐		
☐ RAM, Mini-RAM, Other _____				☐		
☐ Monitox				☐		
Specify: _____				☐		
☐ Personal Sampling				☐		
Specify: _____				☐		
☐ Bio-Aerosol Monitor				☐		
☐ Pump - MSA, Dräeger, Sensidyne				☐		
☐ Tubes/type: _____				☐		
☐ Tubes/type: _____				☐		

SITE OR PROJECT HAZARD MONITORING PROGRAM-FORM 12

Air Monitoring Instruments Calibration Record

Instrument, Mfg., Model, Equip. ID No.	Date	Time	Calib. Material	Calib. Method Mfg.'s	Other	Initial Setting and Reading	Final Setting and Reading	Calibrator's Initials

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SITE AIR MONITORING PROGRAM-FORM 13

Action Levels

These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/TLV/REL. That number must also be adjusted to account for instrument response factors.

	Tasks	Action Level		Action
☐ **Explosive atmosphere**		Ambient Air Concentration	Confined Space Concentration	
		<10% LEL	0 to 1% LEL	Work may continue. Consider toxicity potential.
		10 to 25% LEL	1 to 10% LEL	Work may continue. Increase monitoring frequency.
		>25% LEL	>10% LEL	Work must stop. Ventilate area before returning.
☐ **Oxygen**		Ambient Air Concentration	Confined Space Concentration	
		<19.5% O_2	<19.5% O_2	Leave area. Re-enter only with self-contained breathing apparatus.
		19.5% to 25% O_2	19.5% to 23.5% O_2	Work may continue. Investigate changes from 21%.
		>25% O_2	>23.5% O_2	Work must stop. Ventilate area before returning.
☐ **Radiation**		< 3 times background		Continue work.
		3 times background to < 1 mR/hour		Radiation above background levels (normally 0.01-0.02 mR/hr) signifies possible radiation source(s) present. Continue investigation with caution. Perform thorough monitoring. Consult with a Health Physicist.
		> 1 mrem/hour		Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of Health Physicist.
☐ **Organic gases and vapors**				
☐ **Inorganic gases, vapors, and particulates**				

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Emergency Contacts

CONTINGENCIES-FORM 14

Emergency Contacts and Phone Numbers

Agency	Contact	Phone Number
Local Medical Emergency Facility (LMF)	Emergency Room	330-832-8761
WESTON Medical Emergency Contact	EMR - Dr. Elyane Theriault	1-800-229-3674
WESTON Health and Safety	Corporate Health and Safety	(610) 701-3000
Fire Department	Massillon	911
Police Department	Massillon	911
On-Site Coordinator- SHSC	Dave Cairns/ Jeff Burman	
Client Site Contact	Jeff Burman	330.832.5026
Site Telephone	office	330.832.5026
Nearest Telephone		

Local Medical Emergency Facility(s)

Name of Hospital: Massillon Community Hospital

Address: 875 8th ST Massillon Ohio

Phone No.: 216.832.8761

Name of Contact: Emergency Room

Phone No.:

Type of Service:

- ☐ Physical trauma only
- ☐ Chemical exposure only
- X Physical trauma and chemical exposure
- X Available 24 hours

Route to Hospital (written detail):
Take RIGHT out of the site onto 3rd ST

Take a LEFT onto Cherry ST to 8th ST

Take a LEFT onto 8th ST, go 2 blocks and the hospital is on the LEFT.

Travel time from site: 5

Distance to hospital: 1.5 miles

Name/no. of 24-hr ambulance service: 911 /

Secondary or Specialty Service Provider

Name of Hospital:

Address:

Phone No.:

Name of Contact:

Phone No.:

Type of Service:

- ☐ Physical trauma only
- ☐ Chemical exposure only
- ☐ Physical trauma and chemical exposure
- ☐ Available 24 hours

Route to Hospital (written detail):

Travel time from site:

Distance to hospital:

Name/no. of 24-hr ambulance service: /

Figure 1. Route to Hospital

(Draw map to hospital here if space permits or attach on next sheet.)

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CONTINGENCIES-FORM 16

Response Plans

Medical - General	First Aid Kit:	Type	Location	Special First-Aid Procedures:
Provide first aid, if trained; assess and determine need for further medical assistance. Transport or arrange for transport after appropriate decontamination.	X		SITE VEHICLE	Cyanides on-site ☐ Yes x No If yes, contact LMF. Do they have antidote kit? ☐ Yes ☐ No
	Eyewash required ☐ Yes ☐ No	Type	Location	**HF** on-site ☐ Yes ☐ No If yes, need neutralizing ointment for first-aid kit. Contact LMF.
	Shower required ☐ Yes X No	Type	Location	

Plan for Response to Spill/Release		**Plan for Response to Fire/Explosion**		**Fire Extinguishers**
In the event of a spill or release, ensure safety, assess situation, and perform containment and control measures, as appropriate.	a. Cleanup per MSDSs if small; or sound alarm, call for assistance, notify Emergency Coordinator b. Evacuate to pre-determined safe place c. Account for personnel d. Determine if team can respond safely e. Mobilize per Site Spill Response Plan	In the event of a fire or explosion, ensure personal safety, assess situation, and perform containment and control measures, as appropriate:	a. Sound alarm and call for assistance, notify Emergency Coordinator b. Evacuate to predetermined safe place c. Account for personnel d. Use fire extinguisher <u>only if safe and trained</u> in its use e. Stand by to inform emergency responders of materials and conditions	Type/Location C / vehicle / / / / / /

Description of Spill Response Gear	Location	Description (Other Fire Response Equipment)	Location

Plan to Respond to Security Problems

MAPQUEST. Action canceled

driving directions

- North America
- Europe
- Saved Routes

Yellow Pages

Search **Massillon** for:

Auto repair

Search

FROM:

359 State Ave Nw
Massillon, OH
US

TO:

[857-899] 875 8th St Ne
Massillon, OH
44646-8503 US

Total Distance: 3.94 miles

Total Estimated Time: 11 minutes

PRINT ROUTE | SAVE ROUTE | DOWNLOAD ROUTE TO PDA | E-MAIL ROUTE

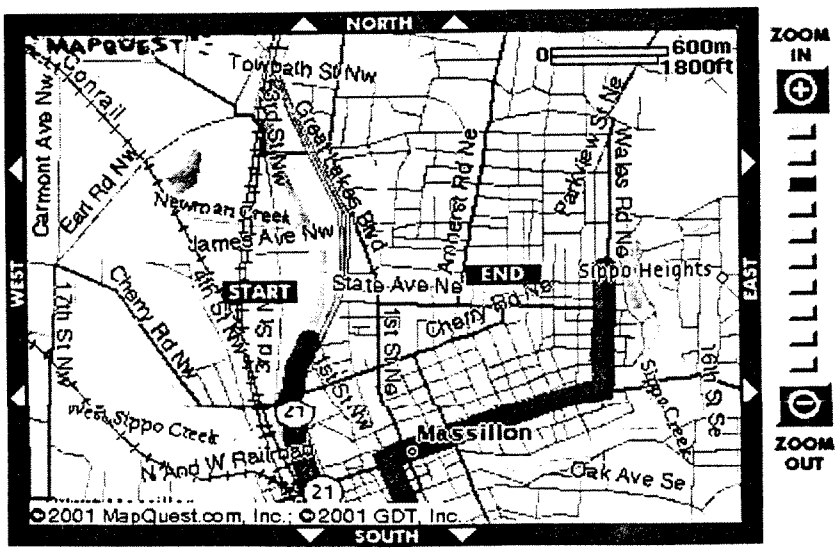
REVERSE DIRECTIONS | FIND LOCATIONS ALONG THE WAY

FASTEST ROUTE | SHORTEST ROUTE | AVOID HIGHWAYS

DIRECTIONS	DISTANCE
There are 0.20 miles between your starting location and the beginning of your driving directions. Use maps to get from your starting location to the beginning of your route.	
There are 0.35 miles between the end of your directions and your destination. Use maps to get from the end of your route to your destination.	
1: Start out going South on OH-21 S by turning right.	1.55 miles
2: Take the OBERLIN AVE ramp towards OH-241.	0.09 miles
3: Turn LEFT onto OBERLIN AVE SW.	0.06 miles
4: Turn LEFT onto ERIE ST S.	1.10 miles
5: Turn RIGHT onto OH-172 E.	0.06 miles
6: OH-172 E becomes OH-172 E/OH-241 N.	0.67 miles
7: Turn LEFT onto OH-241.	0.40 miles
Total Estimated Time: 11 minutes	**Total Distance: 3.94 miles**

Action canceled

ROUTE OVERVIEW:



CLICKING ON MAP WILL: Zoom In Re-center

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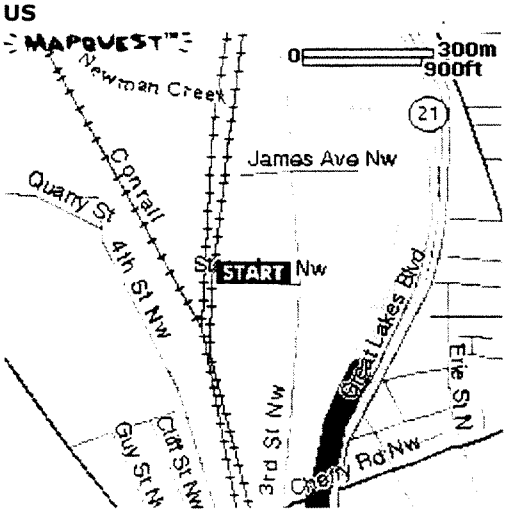
Map Legend NAVTECH ON BOARD

ORIGIN:

359 State Ave Nw
Massillon, OH
US



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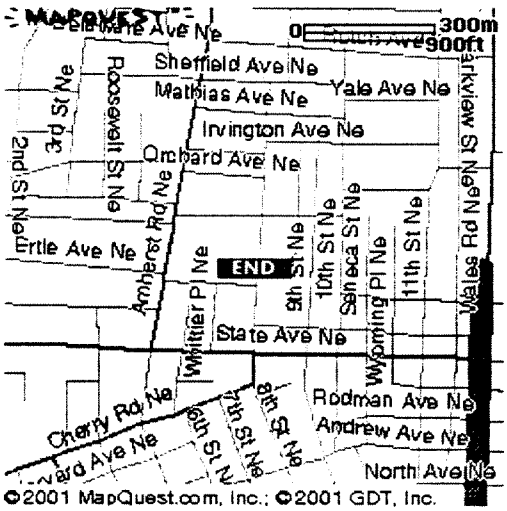
DESTINATION:

[857-899] 875 8th St Ne
Massillon, OH
44646-8503 US



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Re-display Directions with:

Overview Map with Text Text Only Turn-by-Turn Maps with Text

RE-DISPLAY ROUTE

DECONTAMINATION PLAN-FORM 17

Personnel Decontamination

Consistent with the levels of protection required, step-by-step procedures for personnel decontamination for each level of protection are attached.

Levels of Protection Required for Decontamination Personnel

The levels of protection required for personnel assisting with decontamination will be:

☐ Level B ☐ Level C ✠ Level D

Modifications include:

Disposition of Decontamination Wastes

Provide a description of waste disposition, including identification of storage area, hauler, and final disposal site, if applicable:

N/A

Equipment Decontamination

A procedure for decontamination steps required for non-sampling equipment and heavy machinery follows:

Wash equipment with Liquinox & potable water

Potable water wash

Sampling Equipment Decontamination

Sampling equipment will be decontaminated in accordance with the following procedure:

Liquinox & Potable water wash

Potable water wash

DI water rinse

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LEVEL D/MODIFIED LEVEL D DECONTAMINATION PLAN-FORM 18

Check indicated functions or add steps, as necessary:

Function	Description of Process, Solution, and Container
☐ Segregated equipment drop	
☐ Boot cover and glove wash	
☐ Boot cover and glove rinse	
☐ Tape removal - outer glove and boot	
☐ Boot cover removal	
☐ Outer glove removal	
HOTLINE	
☐ Suit/safety boot wash	
☐ Suit/boot/glove rinse	
☐ Safety boot removal	
☐ Suit removal	
☐ Inner glove wash	
☐ Inner glove rinse	
☐ Inner glove removal	
☐ Inner clothing removal	
CONTAMINATION REDUCTION ZONE (CRZ)/SAFE ZONE BOUNDARY	
☐ Field wash	
☐ Redress	

Disposal Plan, End of Day:

Disposal Plan, End of Week:

Disposal Plan, End of Project:

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SITE PERSONNEL AND CERTIFICATION STATUS-FORM 21

WESTON

Name: Dave Cairns **Title: Project Geologist** **Task(s): 1,2,3,4** **Certification Level or Description:** X Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name: Greg Flasinski** **Title: Technician** **Task(s): 1,2,3,4** **Certification Level or Description:** X Medical Current X Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: Mark Eliason **Title: Project Geologist** **Task(s): 1,2,3,4** **Certification Level or Description:** X Medical Current X Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name: Bill Westley** **Title:** **Task(s): 1,2,3,4** **Certification Level or Description:** ☒ Medical Current ☒ Training Current ☒ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)

TRAINING CURRENT - Training: All personnel, including visitors, entering the exclusion or contamination reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910, 29 CFR 1926, or 29 CFR 1910.120.

FIT TEST CURRENT - Respirator Fit Testing: All persons, including visitors, entering any area requiring the use or potential use of any negative pressure respirator must have had, as a minimum, a qualitative fit test, administered in accordance with OSHA 29 CFR 1910.134 or ANSI, within the last 12 months. If site conditions require the use of a full-face, negative-pressure, air-purifying respirator for protection from asbestos or lead, employees must have had a qualitative fit test, administered according to OSHA 29 CFR 1910.1001 or 1025/1926, within the last 6 months.

MEDICAL CURRENT - Medical Monitoring Requirements: All personnel, including visitors, entering the exclusion or contamination reduction zones must be certified as medically fit to work and to wear a respirator, if appropriate, in accordance with 29 CFR 1910, 29 CFR 1926/1910, or 29 CFR 1910.120.

The Site Health and Safety Coordinator is responsible for verifying all certifications and fit tests.

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SITE PERSONNEL AND CERTIFICATION STATUS-FORM 22

Subcontractor's Health and Safety Program Evaluation

Name of Subcontractor:
Address:

Activities To Be Conducted by Subcontractor:

Evaluation Criteria

Medical program meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Personal protective equipment available ☐ Acceptable ☐ Unacceptable Comments:	On-site monitoring equipment available, calibrated, and operated properly ☐ Acceptable ☐ Unacceptable Comments:
Safe working procedures clearly specified ☐ Acceptable ☐ Unacceptable Comments:	Training meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Emergency procedures ☐ Acceptable ☐ Unacceptable Comments:
Decontamination procedures ☐ Acceptable ☐ Unacceptable Comments:	General health and safety program evaluation ☐ Acceptable ☐ Unacceptable Comments:	Additional comments: ☐ Subcontractor has agreed to and will conform with the WESTON HASP for this project. ☐ Subcontractor will work under his own HASP, which has been accepted by project PM.

Evaluation Conducted by: **Date:**

Subcontractor

Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)

Revised 02/1998

HASP: Sign-Off

HEALTH AND SAFETY PLAN APPROVAL/SIGNOFF FORM-FORM 23

Site Name: Ekco Housewares / World Kitchen	**WO#:** 02994-002-009

Address: Ekco Housewares/ World Kitchen
359 State Street EXT.
Massillon, Ohio 44648

I understand, agree to, and will conform with the information set forth in this Health and Safety Plan (and attachments) and discussed in the personnel health and safety briefing(s).

Name	Signature	Date
Dave Cairns		
Greg Flasinski		
Bill Westley		
Mark Eliason		

Revised 02/1998

HASP: Checklists

TRAINING AND BRIEFING TOPICS-FORM 24

The following items will be covered at the site-specific training meeting, daily or periodically.

☒ Site characterization and analysis, Sec. 3.0, 29 CFR 1910.120 I	☐ Level A
☒ Physical hazards, HASP Form 07	☐ Level B
☒ Chemical hazards, HASP Form 04	☐ Level C
☒ Animal bites, stings, and poisonous plants	☒ Level D
☐ Etiologic (infectious) agents	☐ Monitoring, 29 CFR 1910.120 (h)
☒ Site control, 29 CFR 1910.120 d	☐ Decontamination, 29 CFR 1910.120 (k)
☒ Engineering controls and work practices, 29 CFR 1910.120 (g)	☐ Emergency response, 29 CFR 1910.120 (l)
☐ Heavy machinery	☐ Elements of an emergency response, 29 CFR 1910.120 (l)
☐ Forklift	☒ Procedures for handling site emergency incidents, 29 CFR 1910.120 (l)
☐ Backhoe	☒ Off-site emergency response, 29 CFR 1910.120 (l)
☒ Equipment	☒ Handling drums and containers, 29 CFR 1910.120 (j)
☐ Tools	☐ Opening drums and containers
☐ Ladder, 29 CFR 1910.27 (d)/29 CFR 1926	☐ Electrical material handling equipment
☒ Overhead and underground utilities	☐ Radioactive waste
☐ Scaffolds	☐ Shock-sensitive waste
☐ Structural integrity	☐ Laboratory waste packs
☐ Unguarded openings - wall, floor, ceilings	☐ Sampling drums and containers
☐ Pressurized air cylinders	☐ Shipping and transport, 49 CFR 172.101, IATA
☐ Personal protective equipment, 29 CFR 1910.120 (g); 29 CFR 1910.134	☐ Tank and vault procedures
☐ Respiratory protection, 29 CFR 1910.120 (g); ANSI Z88.2	☐ Illumination, 29 CFR 1910.120 (m)
☐	☐ Sanitation, 29 CFR 1910.120 (n)
☐	☐
☐	☐
☐	☐

Revised 02/1998

HEALTH AND SAFETY EVALUATION- 1 CHEMICAL HAZARDS-FORM 25

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☐ Other	☐ Solid ☐ Liquid ☐ Gas	☐ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: MP: Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: Other:	☐ CA _____ ☐ PEL _____ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available ☐ Other:	☐ Inhalation ☐ Ingestion ☐ Skin Absorption ☐ Contact ☐ Direct Penetration ☐ Other: _____	☐ HNu ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ 10.0/10.6 eV ☐ 11.8 eV ☐ CGI ☐ OVA ☐ _____
CAS No:		Incompatible With:					
Synonyms:						Symptoms:	IP: % Response:

Revised 02/1998

SITE-SPECIFIC HAZARD COMMUNICATION PROGRAM-FORM 28

Location-Specific Hazard Communication Program/Checklist

To ensure an understanding of and compliance with the Hazard Communication Standard, WESTON will use this checklist/document (or similar document) in conjunction with the WESTON Written Hazard Communication Program as a means of meeting site- or location-specific requirements.
While responsibility for activities within this document reference the WESTON Safety Officer (SO), it is the responsibility of all personnel to effect compliance. Responsibilities under various conditions can be found within the WESTON Written Hazard Communication Program.
To ensure that information about the dangers of all hazardous chemicals used by WESTON are known by all affected employees, the following Hazard Communication Program has been established. All affected personnel will participate in the Hazard Communication Program. This written program, as well as WESTON's Corporate Hazard Communication Program, will be available for review by any employee, employee representative, representative of OSHA, NIOSH, or any affected employer/employee on a multi-employer site.

- ☐ Site or other location name/address: _____
- ☐ Site/Project/Location Manager: _____
- ☐ Site/Location Safety Officer: _____
- ☐ List of chemicals compiled, format: ☐ HASP ☐ Other: _____
- ☐ Location of MSDS files: _____
- ☐ Training conducted by: Name: _____ Date: _____
- ☐ Indicate format of training documentation: ☐ Field Log: ☐ Other: _____
- ☐ Client briefing conducted regarding hazard communication: _____
- ☐ If multi-employer site (client, subcontractor, agency, etc.), indicate name of affected companies:

  _____
- ☐ Other employer(s) notified of chemicals, labeling, and MSDS information: _____
- ☐ Has WESTON been notified of other employer's or client's hazard communication program(s), as necessary? ☐ Yes ☐ No

List of Hazardous Chemicals

A list of known hazardous chemicals used by WESTON personnel must be prepared and attached to this document or placed in a centrally identified location with the MSDSs. Further information on each chemical may be obtained by reviewing the appropriate MSDS. The list will be arranged to enable cross-reference with the MSDS file and the label on the container. The SO or Location Manager is responsible for ensuring the chemical listing remains up-to-date.

Container Labeling

The WESTON SO will verify that all containers received from the chemical manufacturer, importer, or distributor for use on-site are clearly labeled.
The SO is responsible for ensuring that labels are placed where required and for comparing MSDSs and other information with label information to ensure correctness.

Material Safety Data Sheets (MSDSs) *FORM 28*

The SO is responsible for establishing and monitoring WESTON's MSDS program for the location. The SO will ensure that procedures are developed to obtain the necessary MSDSs and will review incoming MSDSs for new or significant health and safety information. He/she will see that any new information is passed on to the affected employees. If an MSDS is not received at the time of initial shipment, the SO will call the manufacturer and have an MSDS delivered for that product in accordance with the requirements of WESTON's Written Hazard Communication Program.

A log for, and copies of, MSDSs for all hazardous chemicals in use will be kept in the MSDS folder at a location known to all site workers. MSDSs will be readily available to all employees during each work shift. If an MSDS is not available, immediately contact the WESTON SO or the designated alternate. When a revised MSDS is received, the SO will immediately replace the old MSDS.

Employee Training and Information

The SO is responsible for the WESTON site-specific personnel training program. The SO will ensure that all program elements specified below are supplied to all affected employees.

At the time of initial assignment for employees to the work site, or whenever a new hazard is introduced into the work area, employees will attend a health and safety meeting or briefing that includes the information indicated below.

- Hazardous chemicals present at the work site.
- Physical and health risks of the hazardous chemicals.
- The signs and symptoms of overexposure.
- Procedures to follow if employees are overexposed to hazardous chemicals.
- Location of the MSDS file and Written Hazard Communication Program.
- How to determine the presence or release of hazardous chemicals in the employee's work area.
- How to read labels and review MSDSs to obtain hazard information.
- Steps WESTON has taken to reduce or prevent exposure to hazardous chemicals.
- How to reduce or prevent exposure to hazardous chemicals through the use of controls procedures, work practices, and personal protective equipment.
- Hazardous, nonroutine tasks to be performed (if any).
- Chemicals within unlabeled piping (if any).

Hazardous Nonroutine Tasks

When employees are required to perform hazardous nonroutine tasks, the affected employee(s) will be given information by the SO about the hazardous chemicals he or she may use during such activity. This information will include specific chemical hazards, protective and safety measures the employee can use, and steps WESTON is using to reduce the hazards. These steps include, but are not limited to, ventilation, respirators, presence of another employee, and emergency procedures.

Chemicals in Unlabeled Pipes

Work activities may be performed by employees in areas where chemicals are transferred through unlabeled pipes. Prior to starting work in these areas, the employee will contact the SO, at which time information as to the chemical(s) in the pipes, potential hazards of the chemicals or the process involved, and the safety precautions that should be taken will be determined and presented.

Multi-Employer Work Sites

It is the responsibility of the SO to provide other employers with information about hazardous chemicals imported by WESTON to which their employees may be exposed, along with suggested safety precautions. It is also the responsibility of the SO and the Site Manager to obtain information about hazardous chemicals used by other employers to which WESTON employees may be exposed. WESTON's chemical listing will be made available to other employers, as requested. MSDSs will be available for viewing, as necessary. The location, format, and/or procedures for accessing MSDS information must be relayed to affected employees.

SITE AIR MONITORING PROGRAM-FORM 29

Field Data Sheets

Location:

% LEL	% O_2	PID (units)	FID (units)	Aerosol Monitor (mg/m^3)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

Location:

% LEL	% O_2	PID (units)	FID (units)	Aerosol Monitor (mg/m^3)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

Revised 02/1998

AIR MONITORING/SAMPLING DATA LOG-FORM 30

Client:	**W.O. No.:**	**Sample No.:**
Address:	**Sampled By:**	**Date:**

Employee and Location Information

Employee Name:	**Employee No.:**	**Job Title:**

Respirator ☐ APR ☐ ½ Mask ☐ Full Face ☐ PAPR ☐ ½ Mask ☐ Full Face ☐ Hood ☐ SAR ☐ ½ Mask ☐ Full Face ☐ Hood ☐ SCBA	**Manufacturer:**	**Cartridge Type:**

PPE: ☐ Hard Hat ☐ HPD ☐ Gloves ☐ Safety Shoes ☐ Coveralls ☐ Other:

Sampling Data

Sampling Type: ☐ Personal ☐ TWA ☐ STEL ☐ Area ☐ Source ☐ Full Shift ☐ Partial Shift ☐ Grab	**Media:**	**Pump Type/Serial No.:** /
Calibrator/Serial No.: /	**Pre-Calibration:** 1. 2. 3. avg-pre:	**Post-Calibration:** 1. 2. 3. avg-post:

Start Time:	**Restart Time:**	**Restart Time:**	**Avg. Flowrate:**	**% Change:**
1st Stop Time:	**2nd Stop Time:**	**3rd Stop Time:**	**Total Time:**	**Volume:**

Multiple Samples for this TWA: ☐ Yes ☐ No	**Multiple Chemical Exposures:** ☐ Yes ☐ No	**Exposure Time:** ☐ Normal ☐ Worst Case

Sampling Conditions

Weather Conditions: Temp: R.H: B.P.: Other:

Engineering Controls:

Substances Evaluated

Substance	Result	Substance	Result	Substance	Result

Observations and Comments

QA by: **Date**

Revised 02

C:\Documents and Settings\flasinsg\My Documents\ekco\H&Srpt.doc

3.2 MONTHLY EMPLOYEE HEALTH AND SAFETY REPORT

NAME _____ SSN _____ - _____ - _____
(PLEASE PRINT)

REPORTING PERIOD ___/ /___ TO ___/ /___

NO FIELD WORK
During This Period ☐

EMPL. NO. _____ ORG.UNIT _____ OFFICE LOCATION _____
(Use permanent org. unit, not temporary assignment org. unit)

I have been involved in the following projects working with the following hazards:

HAZARD CATEGORY	WORK ORDER NO.	HAZARD(S)*	HOURS WORKED IN EACH LEVEL OF PROTECTION A	B	C	D	SAFETY PLAN READ & SIGNED**
CHEMICAL							
RADIONUCLIDE							
BIOLOGICAL +							
++							
NOISE σ							

* List actual hazards, if known, or attach list from Safety Plan.
** Answer yes or no.
\+ List etiologic (infectious agent) hazards.
++ Poisonous plants, animals, insects.
σ List number of hours exposed to noise in excess of 85 dB.

To the best of my knowledge, I [*check one*] ☐ **have** / ☐ **have not** been injured during the past month, and I [*check one*] ☐ **have** / ☐ **have not** been significantly exposed to any hazard (listed above) requiring the filing of an Incident Report. If **have** is checked in response to either question, an Incident Report was filed on ___/___/___.

Employee Signature _____ Date _____

Safety Officer (SO) Signature _____ Date _____

To Be Completed For Any Month In Which The Employee Performs Field Work.
Return To The SO By The 5th Of The Following Month. Revised 10/1999

3.3 INCIDENT AND NEAR INCIDENT REPORTING PROCESS

EXECUTIVE SUMMARY QUESTIONS

Why did the incident occur?

What should have been done to avoid the incident?

What will be done in the future to avoid similar incidents?

Is this situation indicative of a larger safety problem?

Notice.doc

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected as follow-up reports are completed.

To go to the Risk Management Home Page click here.

Revised 11/1999

NOTIFICATION OF INCIDENT OR NEAR INCIDENT

This form should be used to report all incidents and near-incidents for work–related injuries/illnesses, auto accidents or other liability situations or circumstances. All incidents and near-incidents should be reported in writing to the Risk Manager and Risk Management Associate in the Risk Management Department (RMD) with a copy to the Direct Supervisor of the employee(s) involved, the Division Safety Manager(s), the Corporate Health and Safety Director, Safety Officer(s), Chief Operating Officer, Division Manager(s), Profit & Loss Manager, VP of Human Resources, and other appropriate parties within 24 hours. Verbal reporting of incidents is also recommended to ensure immediate notification to appropriate chain of command individuals. If the incident occurs on a weekend or during off-hours, Risk Manager may be paged at (800) 492-0562.

The NOI form does not relieve the requirement for completion of the Supplementary Record of Occupational Injuries and Illnesses (OSHA 101) or other Company required reporting forms. Call RMD at (610) 701-7413 or (610) 701-3046, if there are any questions.

_____ INJURY / ILLNESS _____ NEAR-INCIDENT _____ OTHER

(e.g. Auto, general liability, subcontractor incident)

DATE/TIME OF OCCURRENCE:

1. Employee(s) / individual(s) involved: Job Title / role: Div./ P&L Center/Org Unit:
2. Project, office or location where incident/near-incident occurred:
3. Incident/near-incident description and resulting injuries / exposures:
4. Treating physician name and recommendations (or responding police department, if applicable):
5. Can personnel return to work?
6. Initial corrective action taken to prevent recurrence:
7. Direct supervisor / and office manager or project manager (whomever is appropriate):
8. Division / local / site safety officer:
9. Has incident been reported to WESTONs insurance carrier(s) or appropriate state agency?
   Why?
10. Is incident OSHA recordable for WESTON? Why?
11. For additional information, contact (name and phone number):

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected as follow-up reports are completed.

Revised 06/1999

SUPPLEMENTRAY RECORD OF OCCUPATIONAL INJURIES AND ILLNESSES - OSHA 101

Complete Part 1, pages 1 and 2 and send to the Risk Management Department at fax # (610) 701-3039 or e-mail within 48 hours of occurrence for each individual incident.

If incident investigation is warranted, complete PART 2 (pages 3, 4 and 5) and forward to the Risk Management Department within five (5) days.

PART 1 (Pages 1 and 2)

THIS REPORT IS:
- ☐ INJURY
- ☐ NEAR-INCIDENT
- ☐ ILLNESS

A. EMPLOYER

☐ WESTON ☐ SUBCONTRACTOR

Employer Name: ____

B. INJURED OR ILL EMPLOYEE

1. Employee Name: _____
2. Social Security #: _____
3. Hire Date: _____
4. Birth Date: _____
5. Sex: ☐ Female ☐ Male
6. Date of Injury or Diagnosis of Illness: _____
7. Time: _____
8. Date Employee Reported to Mgmt./So: _____
9. Where Did Incident/Near-Incident Occur?
   a) On employer's premises? ☐ Yes ☐ No
   b) On established worksite? ☐ Yes ☐ No
   c) Location of Incident: _____
10. Work Order Number: _____
11. Project Manager _____
12. Occupation:
    a) ☐ Manager ☐ Engineer
    ☐ Administrative ☐ Geologist
    ☐ Analyst ☐ Programmer
    ☐ Chemist ☐ Scientist
    ☐ Facilities/Mail ☐ Technician-Lab or Field
    ☐ Coordinator ☐ Mechanic
    ☐ Editor ☐ Computer/Equipment Operator
    ☐ Designer ☐ Business Professional
    ☐ Other : _____
    b) ☐ Full-time ☐ Union
    ☐ Part-time ☐ Temporary
13. Organizational Unit and Profit Center of Injured/Ill Employee: _____

C. OSHA RECORDABLE INJURY OR ILLNESS

- ☐ Injury
- ☐ Illness
- ☐ Chemical exposure-(short term)

Provide Details:

_____
_____
_____
_____

D. THE INCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

1. What Was the Employee Doing When Incident/Near-Incident Occurred?

_____
_____
_____

a) Task Performed at Time of Incident/Near-Incident *(check one or more if applicable)*:
- ☐ Construction task
- ☐ Field task (not construction)
- ☐ Laboratory task
- ☐ Operating machine/computer
- ☐ Operating hand tool (power or nonpower)
- ☐ Materials handling-lifting/pushing
- ☐ Maintenance & repair-building & equipment
- ☐ Motor vehicle driver, operator or passenger
- ☐ Office work
- ☐ Other: _____
- ☐ Not performing task

b) Activity at Time of Incident/Near-Incident *(check one or more if applicable)*
- ☐ Climbing ☐ Kneeling
- ☐ Driving ☐ Grasping
- ☐ Jumping ☐ Lifting
- ☐ Bending ☐ Running
- ☐ Sitting ☐ Twisting
- ☐ Standing, walking ☐ Repetitive motion
- ☐ Reaching, stretching
- ☐ Other: _____

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2. How Did the Incident/Near-Incident Occur?
(Describe fully the events)

_____
_____
_____
_____

3. Agent of Incident

a) *(Object or substance involved, check one or more box(es), if applicable)*

- ☐ Glassware/sharp object
- ☐ Computer keyboard
- ☐ Electrical apparatus
- ☐ Door, window, etc.
- ☐ Floor, walking surface
- ☐ Bricks, rocks, stones
- ☐ Biological (bite, sting)
- ☐ Vehicle
- ☐ Hand tool
- ☐ Chemical
- ☐ Ladder
- ☐ Metal
- ☐ Stairway, steps
- ☐ Heavy equipment
- ☐ Working surface, bench, table, etc.
- ☐ Box, barrel, container *(empty or full)*
- ☐ Lumber, woodworking materials
- ☐ Other: _____
- ☐ None

b) Incident Type *(1st event in the incident sequence)*

- ☐ Material handling-lifting
- ☐ Caught in, under or between
- ☐ Rubbed or abraded
- ☐ Bodily reaction (stings, bites)
- ☐ Contact with electrical current
- ☐ Motor vehicle accident
- ☐ Fall from elevation
- ☐ Fall on same level
- ☐ Struck against
- ☐ Struck by
- ☐ Overexertion
- ☐ Burn, frostbite
- ☐ Equipment or machinery accident
- ☐ Contact with radiations, caustics, toxic, and chemical substances
- ☐ Other: _____

4. Describe the Injury or Illness in Detail.

_____
_____
_____

a) Nature of Injury or Illness. *(check most serious one)*

- ☐ Amputation
- ☐ Burn and scald(heat)
- ☐ Burn(chemical)
- ☐ Bruise, contusion
- ☐ Bite, sting
- ☐ Concussion
- ☐ Crushing injury
- ☐ Fracture
- ☐ Sprain, strain
- ☐ Hernia
- ☐ Cut, laceration, puncture, abrasion
- ☐ Occupational illness *(repetitive trauma, poison ivy)*
- ☐ Other: _____

b) Part of the Body *(check most serious ones)*

- ☐ Eyes
- ☐ Head/face/neck/ears
- ☐ Back
- ☐ Leg/ankle
- ☐ Fingers
- ☐ Trunk
- ☐ Arm/elbow
- ☐ Hand & wrist
- ☐ Foot/toes
- ☐ Ribs
- ☐ Internal *(i.e. respiratory, gastrointestinal)*
- ☐ Other: _____

☐ Left ☐ Right

5. Lost or Restricted Time Anticipated?
☐ Yes ☐ No

6. Was There Property Damage Due to the Incident?
☐ Yes ☐ No
If "Yes" List Damage:

_____

7. Corrective Actions/Recommendations
(Responsible Manager in conjunction with Safety Officer)
(attach additional sheet if necessary):

_____
_____
_____
_____
_____
_____

a) Have all of the corrective actions(s) been completed?
☐ Yes ☐ No

b) If no, planned date of completions: _____

c) Current status of corrective action(s):
*
_____
_____
_____

8. Name of treating Medical Provider:

_____

Telephone No.: ( ) -

☐ Return to work form completed by physician
(attach if completed)

E. REVIEW OF DOCUMENTATION

(signature indicates complete review)

1. _____
Employee's Name

_____
(Signature) *(Date)*

2. _____
Direct Supervisor/ Office Manager's Name

_____
(Signature) *(Date)*

3. _____
Safety Officer's Name

_____
(Signature) *(Date)*

4. _____
Project Manager's Name (if applicable)

_____
(Signature) *(Date)*

[End Part 1]

Revised 10/1999

PART 2—INCIDENT INVESTIGATION
(Pages 3, 4, and 5)

Please use space below each question for comments.

F. MITIGATING CAUSAL FACTORS

1. List mitigating/causal factors, which contributed to the incident (or cause and effect factors such as weather conditions, improper use of equipment, etc.):

   _____

   _____

   _____

2. Were environmental conditions a contributing factor?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   ☐ Inadequate lighting ☐ Too hot
   ☐ Inadequate ventilation ☐ Too cold
   ☐ High noise levels ☐ Wet/slippery
   ☐ Unsteady surface ☐ Dirty/untidy conditions
   ☐ Other _____

3. Did the location of the equipment, materials, or employees contribute to a hazardous condition?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   a) Was the hazardous condition recognized prior to injury?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   b) Was the hazardous condition reported prior to injury?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   c) Was the employee trained in job procedure under the environmental conditions noted prior to injury?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   d) Was the hazardous condition visible to the employee(s) prior to injury?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

4. Was the employee supposed to be in the area or in the vicinity of the equipment/materials?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

5. Was sufficient workspace available to move about safely?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

6. Was there a fault/defect in equipment or is its usage a contributing factor?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

7. Was equipment being used for some other purpose other than designed or intended?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

8. Was the correct equipment being used?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

9. Was the equipment being used correctly?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

10. Was the equipment being used in such a manner as to create a hazardous condition?
    ☐ Yes ☐ No ☐ N/A ☐ Unknown

11. Was the defect recognized?
    ☐ Yes ☐ No ☐ N/A ☐ Unknown

12. Was the defect reported?
    ☐ Yes ☐ No ☐ N/A ☐ Unknown

13. Was the employee trained in use of the equipment and recognition of unsafe equipment conditions?
    ☐ Yes ☐ No ☐ N/A ☐ Unknown

14. Was the equipment's structure or design outdated for the purpose it was still being used for?
    ☐ Yes ☐ No ☐ N/A ☐ Unknown

15. Could the incident have been prevented by the equipment being:
    ☐ Discarded ☐ Tagged/repaired
    ☐ Replaced by newer model ☐ Unknown
    ☐ Other _____

G. JOB PROCEDURES

1. Was a fault in inspection or job procedures a contributing factor?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

2. Were there specific job procedures that were followed for this job?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   a) Did these job procedures warn of possible employee hazards?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   b) Was the employee injured by one of the listed hazards?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   c) Was the employee trained, and is it documented, to know of the possible hazards he/she was exposed to?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   Date of Training: _____

3. Was the employee trained, and is it documented, to know the correct procedures for this job?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   Date of Training: _____

4. Did the employee deviate from the known job procedure?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

5. Is the job structured to encourage deviation from job procedures?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

Revised 10/1999

H. INSPECTION PROCEDURES

1. Was there a procedure for inspecting equipment?
   ☐ Yes ☐ No ☐ N/A
   a) Was this inspection to be performed on a regular basis?
      ☐ Yes ☐ No ☐ N/A
   b) Had the last equipment inspection been performed on schedule?
      ☐ Yes ☐ No ☐ N/A
   c) Did the last inspection discover a defect or a hazardous condition?
      ☐ Yes ☐ No ☐ N/A
   d) Were inspection procedures structured to detect a hazard or defect?
      ☐ Yes ☐ No ☐ N/A

I. PROTECTION

1. Was emergency or personal equipment a contributing factor?
   ☐ Yes ☐ No ☐ N/A

J. PERSONNEL PROTECTION EQUIPMENT

1. Was PPE specified for the job or task?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown
   a) Was PPE available?
      ☐ Yes ☐ No ☐ N/A ☐ Unknown
   b) Did employee know that wearing specified PPE was required?
      ☐ Yes ☐ No ☐ N/A ☐ Unknown
2. Did employee know how to correctly use and maintain the PPE?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown
3. Was the employee trained on this use of the PPE and its maintenance?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

   Date of Training: _____
4. Was the PPE being used correctly?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown
5. Was PPE adequate/appropriate for the job task?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

K. EMERGENCY EQUIPMENT

1. Was emergency equipment specified for the job or task?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown
   a) Was emergency equipment readily available?
      ☐ Yes ☐ No ☐ N/A ☐ Unknown
   b) Did employee know where emergency equipment was located?
      ☐ Yes ☐ No ☐ N/A ☐ Unknown
   c) Did employee know how to use the emergency equipment?
      ☐ Yes ☐ No ☐ N/A ☐ Unknown
2. Was the emergency equipment functioning properly?
   ☐ Yes ☐ No ☐ N/A ☐ Unknown

L. WITNESS(ES)

	( ) -
(Name)	*(Phone Number)*
	( ) -
(Name)	*(Phone Number)*

M. CHECKLIST

(Complete during investigation)

- ☐ Drawing
- ☐ Photos taken
- ☐ Interviews completed
- ☐ Investigation completed
- ☐ Samples taken

N. Investigator Comments Section

_____ _____ _____

(Print Investigator's Name) *(Investigator's Signature)* *(Date)*

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O. Risk Management Comments Section

INCIDENT **ANALYSIS**

(for Risk Management Department's use only)

FIRST AID?	☐ YES	☐ NO
ILLNESS?	☐ YES	☐ NO
ERGONOMICALLY RELATED?	☐ YES	☐ NO
OSHA RECORDABLE?	☐ YES	☐ NO
REPORTED TO CARRIER(S)?	☐ YES	☐ NO

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3.4 NEW EMPLOYEE HEALTH and SAFETY CHECKLIST

Employee Name:_____
Date:_____

Emergency Information:
- ❑ Employee Phone Numbers:
- ❑ During Work Hours.
- ❑ Nights and Weekends.
- ❑ Evacuation Routes and Meeting Areas.
- ❑ Location and Use of:
- ❑ First Aid Kits.
- ❑ Fire Alarms.
- ❑ Fire Extinguishers.
- ❑ Response to incidents.

Safety Personnel:
- ❑ Division Safety Manager (name, location, phone, pager).
- ❑ Local Safety Officer (name, location, phone, pager).
- ❑ Division Manager (name, location, phone).
- ❑ Profit Center Manager/Office Manager/Supervisor (names,locations, phones, pagers)

Potential Training Requirements: (check if completed)
- ❑ Field Workers:
- ❑ HAZWOPER.
- ❑ DOT/IATA.
- ❑ Confined Space.
- ❑ Construction.
- ❑ Asbestos.
- ❑ BBP.
- ❑ Commercial Driver License
- ❑ Other (e.g., Lift truck)
- ❑ Office and Field Workers:
- ❑ Hazard Communication.
- ❑ Office Safety.
- ❑ Ergonomics.
- ❑ Copies of any Previous Certifications.

Potential Medical Surveillance Requirements (Field Personnel):
- ❑ HAZWOPER.
- ❑ Asbestos.
- ❑ Lead.
- ❑ D.O.T.
- ❑ Previous Medical Clearance Exams?
- ❑ Other.

Incident Reporting Procedures:
- ❑ Report immediately to supervisor and local safety officer.
- ❑ Report work-related injuries and illnesses.
- ❑ Report near-miss incidents, including automobile damage and property damage.

Other Issues:
- ❑ Corporate Ombudsman.
- ❑ Local Safety Committee.
- ❑ Parking Area Safety Issues.
- ❑ Working Alone Safety Issues.

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3.5 HEALTH AND SAFETY FIELD AUDIT

Legend X = Yes, O = No

SITE NAME:_____

WO #:_____

LOCATION:_____

INSPECTOR:_____

DATE:_____

CERTIFICATION OF PERSONNEL:

1._____ All WESTON personnel on site are currently active on certification list?
2._____ Site Safety Officer and Site Supervisor are qualified?

MEDICAL AND FIRST AID:

1._____ First Aid Kits accessible and identified?
2._____ Emergency eye/safety washes available?
3._____ Daily First Aid logs up to date?
4._____ First Aid Kits inspected weekly?
5._____ At least two First Aid trained persons on site at all times when working?

SITE SAFETY/EMERGENCY PLANS:

1._____ Safety plan posted on site and given to each person?
2._____ Initial site safety plan meeting held and documented before work begins?
3._____ Hazardous materials information available for all hazards?
4._____ Designated, qualified site health and safety coordinator on site?
5._____ Employees trained in toxicology/exposure risks?
6._____ Emergency telephone numbers posted?
7._____ Emergency routes designated?
8._____ Emergency plan and signal reviewed with all persons?

TRAINING:

1._____ Daily safety meetings documented?
2._____ Question and answer time available to all site personnel?
3._____ All employees instructed in hazardous materials handling practices?
4._____ New personnel to site receive: copy of safety plan_____, site orientation_____, Review of: LOP_____, DECON____, ZONES_____, Site specific safety and health hazards?____

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HEALTH AND SAFETY FIELD AUDIT - Continued

Legend X = Yes, O = No

PERSONAL PROTECTION:

1._____ All equipment meets ANSI/OSHA/EPA criteria?
2._____ Levels of protection (LOP) established?
3._____ Site control zones (Exclusion, CRZ, Support) clearly designated?
4._____ All employees know their LOP scheme?
5._____ OSHA respirator program in place?
6._____ Employees fit tested for respirators?
_____ On site?
_____ Fit tests current?
7._____ Defective equipment tagged out?
8._____ Breathing air grade "D" certified?
9._____ Sufficient quantities of equipment?
10.____ Safety instrumentation maintained and calibrated?
_____ Maint. & Cal. logs up to date?

DECONTAMINATION:

1._____ Decon system set up on site?
_____Used?
_____According to safety plan?
2._____ Contamination reduction corridor clearly delineated within the CRZ?
3._____ Appropriate waste recepticals available for all waste?
4._____ Recepticals properly closed at end of day?
5._____ All Decon liquids properly contained and disposed of?
6._____ All wastes disposed of according to approved plan?
7._____ All personnel received Decon training?
8._____ All reusable personal protective gear deconned and disinfected at least daily?

FIRE PREVENTION/PROTECTION:

1._____ Hot work permits required?
2._____ Smoking restricted to designated area?
3._____ Fire lanes established, clearly designated & maintained?
4._____ Flammable/combustible liquid dispensing transfer systems grounded & bonded?
5._____ Proper flammable materials storage?
6._____ Fire alarm established, workers aware?
7._____ Location and use of fire extinguisher known by all personnel?
8._____ Fire extinguishers checked before each shift?
_____ Inspected monthly?
9._____ Fire extinguisher appropriate for fire hazard potential?
10.____ Combustible materials segregated from ignition sources?

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Legend X = Yes, O = No

WALKING AND WORKING SURFACES:

1._____ Accessways, stairs, ramps and ladders free of ice, mud, snow or debris?
2._____ Ladders exceed max length?
3._____ Ladders used in passageways, doors or driveways?
4._____ Broken or damaged ladders tagged out?
5._____ Metal ladders prohibited in electrical service?
6._____ Safety feet on straight and extension ladders?
7._____ Stairways, floor and wall openings guarded?
8._____ Elevated work areas guardrailed or safety chained?
9._____ Flotation devices worn when working on or over water?
10.____ Toe boards on overhead work surfaces?
11.____ Mobile offices/labs have fixed stairs and handrails?
12.____ Work areas kept free of debris and equipment?

EXCAVATIONS, CONFINED SPACES, TUNNELS:

1._____ Excavations sloped, shored or benched to prevent cave-ins?
2._____ Shoring approved by engineer?
3._____ Guardrails or fences placed around excavations near walkways or roads?
4._____ Excavation locations lighted/or otherwise made visible at night?
5._____ Utility check performed and documented before excavation or drilling?
6._____ Ladders available in trenches more than 4 feet deep and at a minimum, 25' intervals along a fence?
7._____ All excavated material, personnel, heavy equipment is at least 24" from the edge of all trenches?
8._____ Confined space entry permit procedure in place and communicated to all?
9._____ Employee training includes CSE hazards?
10.____ Tunnels are adequately ventilated?
11.____ There is proper lighting?
12.____ Tunnel tested for: % O_2?
_____ LEL, flammable gases, vapors?
_____ TOX?
13.____ Communication available inside to out?
14.____ No flammables or combustibles in tunnel?
15.____ CSE procedures used for Tunnels?
16.____ CSE procedure checklist:
_____ Safety watch?
_____ Safety watch protected same as enterers?
_____ Safety line?
_____ Appropriate harness?
_____ Continuous monitoring for % O_2, % LEL & TOX?

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Legend X = Yes, O = No

EXCAVATIONS, CONFINED SPACES, TUNNELS (continued):

_____ Level B or constant ventilation and monitoring?
_____ Instruments calibrated?
_____ Maintain and inspect log for all equipment?

17.____ Confined space isolated from electrical/mechanical activation by following lock out/tag out proceedings?
_____ Confined space isolated from any raw materials/chemical lines by disconnecting or blanking these lines?

MOTOR VEHICLES/HEAVY EQUIPMENT:

1._____ Inspected before each use?
2._____ Operators licensed for equipment used?
3._____ Unsafe equipment tagged out and reported?
4._____ All safety appliances/guards in place?
5._____ Shut down for fueling?
6._____ Equipped with back-up alarms or spotter used if 360° visibility restricted?
7._____ Loads are secure before transport?
8._____ Roads and structures inspected for load capacity per vehicle weights?
9._____ Riders prohibited on heavy equipment?

SLINGS AND CHAINS:

1._____ Slings, chains and rigging rated for intended use and inspected per OSHA. Documentation of inspection in daily log?
2._____ Damaged slings, chains or rigging tagged out and reported?
3._____ Employees are instructed and keep clear of suspended loads?

ELECTRICAL:

1._____ Warning signs indicate the presence and location of high voltage equipment, 250 V or greater present and location?
2._____ Electrical equipment and wiring properly guarded?
3._____ Electrical lines, extension cords and cables guarded and properly maintained?
4._____ Extension cords kept dry out of puddles and rain?
5._____ Damaged equipment tagged out?
6._____ Underground electrical lines located and indicated?
7._____ Overhead electrical lines de-energized or elevated work platforms, work areas, booms or ladders erected so no contact can occur with electrical lines?
8._____ A positive electrical lock-out system is used whenever work is done on or in electric equipment or electrically activated equipment?

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Legend X = Yes, O = No

HAND AND POWER TOOLS:

1._____ Guards and safety devices in place and used?
2._____ Inspected before each use?
3._____ Tagged out if defective?
4._____ Eye protection areas identified and protection worn?
5._____ Non sparking tools available?

WELDING AND CUTTING:

1._____ Fire extinguishers present at all welding and cutting operations?
2._____ Confined spaces, tanks, pipelines tested before welding or cutting?
3._____ Hot work permitting system in use?
4._____ Proper helmets and shields (including proper tint for UV protection) used?
5._____ Properly grounded?
6._____ Fuel gas and O_2 gas cylinders stored at least 20'apart?
_____ Stored upright and secured?
7._____ Only trained welders permitted?

COMPRESSED GAS CYLINDERS/PRESSURIZED LINES:

1._____ Breathing air cylinders charged only to prescribed pressure?
2._____ No other gas system can be mistaken for breathing air?
_____ Fittings prohibit cross connection?
3._____ Cylinders segregated appropriately in controlled, protected but well ventilated areas?
4._____ Smoking prohibited in storage areas?
5._____ Cylinders stored upright and secured?
6._____ Cylinder caps in place when stored (not in use) or when cylinders moved?
7._____ Fuel gas and O_2 minimum 20' apart when stored?
8._____ Pressurized air or waterlines are securely connected?
9._____ All site personnel know never to step across a pressurized line?
10.____ Gas or other hazardous lines are labelled appropriately?

MISCELLANEOUS:

1._____ Tools and other equipment (portable) are stored away from walkways, roads or driveways where they cannot fall on or be fallen over by site personnel?
2._____ Overhead hazards are noted, communicated to all and labeled as needed?
3._____ Hard hat, eye hearing and protection areas are defined and signs in place?
4._____ Hard hats, eye and head protection used where appropriate?
5._____ Signs or labels are in place or appropriate training received?

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HEALTH AND SAFETY FIELD AUDIT - Continued

Legend X = Yes, O = No

6._____ Copies of contracts with client and sub-contractors are on-site, WESTON's role regarding site health and safety responsibilities clear in these and in the minds of the site manager(s)?

7._____ Sub-contractors have received approved copies of their safety plan or have signified their intent to conform with Weston's safety plan?

8._____ Site managers understand their responsibilities for sub-contractors' conformance with all OSHA and other health and safety requirements?

9._____ Site managers know what to do in the event of an OSHA inspection?

COMMENTS:

_____

_____

_____

_____

_____

_____

_____

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3.6 MANAGER'S FIELD SITE HEATLH AND SAFETY AUDIT FORM

PM name: _____ Date: _____
Client name: _____ W.O. No.: _____
Site location: _____ Site phone no.: _____
Inspection conducted by:
__ PM in person __ PM via phone (Contact Name: _____)
__ PM's designee (Designee's Name: _____)

1. Is the HASP available at the site? __yes __no Signed by all personnel? __yes __no
(Have the cover page and site worker sign-off page faxed and attached to this form.)

2. What tasks are active? _____.

3. What special H&S considerations are necessary? (e.g., confined spaces, fall protection, construction safety, excavation evaluations, radiation, etc.) _____
_____.

4A.List the name of the SHSC/FSO on Line (a) and any other employees working at the site on lines (b) through (i). Verify and check (✓) if field certifications are current:

Name	RFW or Sub?	Training	Medical	Fit Test
a.				
(For above, circle: SHSC or FSO)				
b.				
c.				
d.				
e.				
f.				
g.				
h.				
i.				

4B.For large projects, is documentation on-site for employee certifications? __yes __no __NA

5. Is emergency contact information available on-site? __yes __no
(Have a copy faxed from the site and attached to this report.)

6. Describe the ambient temperatures during recent work shifts: _____.

PM Signature/Date: _____ Page 1 of 2

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7. Was the level of PPE used for each task today as required by the HASP? __yes __no

8A. What contaminant monitoring is conducted? _____.

8B. How are results documented? ___Logbook ___Forms ___other (describe): _____.
(Have the most recent results and calibration information faxed and attached to this form.)

9. What other monitoring is done? (e.g., heat stress, cold, noise, etc.) _____.

10. How are work zones marked and/or designated? _____.

11. Are personnel and equipment decon performed as required by the HASP? __yes __no

12. Are first aid and CPR services provided as required by the HASP? __yes __no

13. When were first aid kits, BBP kits, and fire extinguishers last inspected? _____.
(Have documentation faxed and attached to this form.)

14. Was site-specific hazard communication completed and properly documented? __yes ___no
(Have checklist in HASP Attachment D faxed and attached to this form.)

15. When was the last safety briefing conducted? _____. List topic(s) discussed:
_____.
(Have minutes/sign-up sheet faxed and attached to this form.)

16. Explain any negative findings below: _____

PM Signature/Date: _____

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3.7 OFFICE AREA INSPECTIONS CHECKLIST

Location: **Date:**

OFFICE AREA INSPECTION CHECKLIST	
Location:	Inspection Date:
Supervisor:	Follow-Up Date:
Inspected By:	Inspection Periods: Monthly ☐ Quarterly ☐

OFFICE AREAS/WALKING SURFACES/HOUSEKEEPING/STORAGE				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Aisles correctly established and clear (29 CFR 1910.22, 1910.36)			
☐ Yes ☐ N/A	No tripping hazards in evidence (29 CFR 1910.22)			
☐ Yes ☐ N/A	Floor(s) even (no holes or cracks) (29 CFR 1910.22)			
☐ Yes ☐ N/A	No electrical wires stretched across aisles (29 CFR 1910.22, 1910.305)			
☐ Yes ☐ N/A	Floors dry - not slippery (29 CFR 1910.22)			
☐ Yes ☐ N/A	Carpets and rugs secure (29 CFR 1910.22)			
☐ Yes ☐ N/A	No samples or hazardous materials (except office supplies) stored in offices or office storage areas (29 CFR 1910.106(d)(5))			
☐ Yes ☐ N/A	MSDSs for office chemicals available, accessible, and locations known to personnel (29 CFR 1910.1200)			
☐ Yes ☐ N/A	Adequate clearance in aisles where materials must be moved (29 CFR 1910.22)			
☐ Yes ☐ N/A	Storage areas free of tripping, fire, and pest hazards (29 CFR 1910.176)			
☐ Yes ☐ N/A	Outside walkways, parking areas in good repair (29 CFR 1910.22)			

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OFFICE AREA INSPECTIONS CHECKLIST- Continued

Location: **Date:**

STAIRWAYS, HALLS, RAMPS, STORAGE AREAS				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Adequate lighting suitable for type of work done			
☐ Yes ☐ N/A	Ramps have non-slip surfaces (29 CFR 1910.22)			
☐ Yes ☐ N/A	Stairways kept clear (29 CFR 1910.22)			
☐ Yes ☐ N/A	Stair treads in good condition (29 CFR 1910.24)			
☐ Yes ☐ N/A	Handrails installed and in good condition (29 CFR 1910.24)			
☐ Yes ☐ N/A	Guardrails installed and in good condition (29 CFR 1910.23)			
☐ Yes ☐ N/A	Halls clear of equipment and supplies (29 CFR 1910.22)			

BOOKCASES, SHELVES, CABINETS				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Shelves not overloaded (29 CFR 1910.176)			
☐ Yes ☐ N/A	Heavy storage shelves secured to wall (29 CFR 1910.176)			
☐ Yes ☐ N/A	Heavy storage files secured from tipping (29 CFR 1910.176)			
☐ Yes ☐ N/A	Bookcases secured from tipping (29 CFR 1910.176)			

OFFICE EQUIPMENT, DUPLICATING MACHINES, TOOLS				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	File cabinets secure (29 CFR 1910.176)			
☐ Yes ☐ N/A	File drawers closed when not in use (29 CFR 1910.176)			
☐ Yes ☐ N/A	File drawers not overstuffed (29 CFR 1910.176)			
☐ Yes ☐ N/A	Chairs (springs, casters) in good mechanical condition, free of splinters and rough edges			

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OFFICE AREA INSPECTIONS CHECKLIST- Continued

Location: **Date:**

OFFICE EQUIPMENT, DUPLICATING MACHINES, TOOLS (Continued)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Fans guarded, secure from falling or tipping (29 CFR 1910.212)			
☐ Yes ☐ N/A	Paper cutter equipped with guard; blade spring functioning (29 CFR 1910.212)			
☐ Yes ☐ N/A	Paper shredder guarded (29 CFR 1910.212)			
☐ Yes ☐ N/A	Safe (non-rolling type) step stools used when needed			
☐ Yes ☐ N/A	Step stools kept clear of aisleways when not in use (29 CFR 1910.22)			
☐ Yes ☐ N/A	No complaints of ventilation problems			
☐ Yes ☐ N/A	Ozone filters replaced as required on laser printers and other office equipment			
☐ Yes ☐ N/A	Paper, supplies, materials safely stacked (29 CFR 1910.176)			
☐ Yes ☐ N/A	Knives, scissors, other sharp tools used/stored correctly			
☐ Yes ☐ N/A	Tops of file cabinets kept clear of excess materials (e.g., boxes, papers, binders) (29 CFR 1910.176)			
☐ Yes ☐ N/A	Handtrucks available and in good condition			

ERGONOMICS				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	New employees receive training and workstation evaluations and modifications			
☐ Yes ☐ N/A	Workstation evaluations completed as scheduled			

ELECTRIC HAZARDS (29 CFR 1910 Subpart S)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Machines and equipment appropriately grounded			
☐ Yes ☐ N/A	Electrical outlets not overloaded			
☐ Yes ☐ N/A	Extension cords approved or 3-wire type			
☐ Yes ☐ N/A	Power cords in good condition (not patched or spliced)			

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OFFICE AREA INSPECTIONS CHECKLIST- Continued

Location: **Date:**

ELECTRIC HAZARDS (29 CFR 1910 Subpart S) (Continued)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Floor electrical outlets protected from tripping hazard (29 CFR 1910.22)			
☐ Yes ☐ N/A	Plugs and wall outlets maintained in safe condition			
☐ Yes ☐ N/A	Electric switch panels clear for access (at least 30" side, 3' front)			
☐ Yes ☐ N/A	Combustible materials not stored within 5 ft of switch panels			
☐ Yes ☐ N/A	No wires under carpets			
☐ Yes ☐ N/A	Electric heaters safety rated/approved			

FIRE PREVENTION (29 CFR 1910.37, 1910.38, 1910.157)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Fire Exits marked			
☐ Yes ☐ N/A	Employees have unobstructed access to Fire Exits			
☐ Yes ☐ N/A	Fire Exits allow prompt escape			
☐ Yes ☐ N/A	Fire pull stations visible and accessible			
☐ Yes ☐ N/A	Fire extinguishers properly marked and installed			
☐ Yes ☐ N/A	Fire extinguishers appear to be in proper working order			
☐ Yes ☐ N/A	Fire extinguishers have current inspection tag			
☐ Yes ☐ N/A	Fire extinguishers appropriate for likely types of fires and applications			
☐ Yes ☐ N/A	Fire extinguisher access not blocked or obstructed			
☐ Yes ☐ N/A	Fire doors not blocked open			
☐ Yes ☐ N/A	Sprinkler heads not blocked			
☐ Yes ☐ N/A	Excess paper and trash removed			

EMERGENCY PREPAREDNESS (29 CFR 1910.37, 1910.38)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Emergency exit routes prominently posted			
☐ Yes ☐ N/A	Aisles used as primary emergency exits have minimum clearance of 36"			
☐ Yes ☐ N/A	Emergency lights available (visible and audible warning signals)			

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OFFICE AREA INSPECTIONS CHECKLIST- Continued

Location: **Date:**

EMERGENCY PREPAREDNESS (29 CFR 1910.37, 1910.38) (Continued)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Emergency phone numbers posted			
☐ Yes ☐ N/A	Office/Laboratory First Aid kits fully stocked			
☐ Yes ☐ N/A	Field/Vehicles First Aid kits fully stocked (29 CFR 1910.151)			
☐ Yes ☐ N/A	Bloodborne pathogen kits (BBP) available, fully stocked, and readily accessible (29 CFR 1910.1030)			
☐ Yes ☐ N/A	List of First Aid trained persons posted (29 CFR 1910.151, 1910.38)			
☐ Yes ☐ N/A	Evacuation routes posted (29 CFR 1910.151, 1910.38)			
☐ Yes ☐ N/A	Maps to medical facility available (29 CFR 1910.150, 1910.138)			
☐ Yes ☐ N/A	Required notices posted (OSHA or State OSHA, State Right-to-Know, Workers' Compensation) (29 CFR 1903.2)			
☐ Yes ☐ N/A	Evacuation procedure for persons with disabilities (buddy system?)			

ADA ACCESS (Americans with Disabilities Act of 1990)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Route from parking to building entrance is level and clear of obstructions.			
☐ Yes ☐ N/A	Reserved parking provided/designated for people with disabilities (above-ground sign) and "van accessible" parking provided (wide access aisle)			
☐ Yes ☐ N/A	Building entrance accessible to people with disabilities			
☐ Yes ☐ N/A	All exterior/interior doors and hallways wide enough for wheelchair use (minimum 36") (and lever door handles provided) and doors not too heavy (operable with 8 lbs of force)			
☐ Yes ☐ N/A	Restrooms properly designed and marked for people with disabilities			
☐ Yes ☐ N/A	Soap and towel dispensers and mirrors within reach of wheelchair (48" forward reach, 54" parallel reach)			
☐ Yes ☐ N/A	Proper knee clearance (29") under sink and insulated pipe to prevent burns			
☐ Yes ☐ N/A	Grab bars properly mounted in toilet stall			
☐ Yes ☐ N/A	Toilet stall door swings out and is 36" wide			
☐ Yes ☐ N/A	Toilet room entrance provides sufficient space for wheelchair			

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OFFICE AREA INSPECTIONS CHECKLIST- Continued

Location: **Date:**

ADA ACCESS (Americans with Disabilities Act of 1990)(Continued)				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Drinking fountains usable from a wheelchair			
☐ Yes ☐ N/A	Public telephones usable from a wheelchair			
☐ Yes ☐ N/A	Proper signage throughout building (high contrast, raised letters, Braille)			
☐ Yes ☐ N/A	Entrance to elevator(s) smooth and flush with the adjacent floor			
☐ Yes ☐ N/A	Elevator controls are usable from wheelchair and marked in "Braille" and raised letters (proper signage on door jambs).			
☐ Yes ☐ N/A	Elevator(s) containing emergency telephone(s) (if any) usable from a wheelchair			
☐ Yes ☐ N/A	Building in which workplace is located has passenger/freight elevators			
☐ Yes ☐ N/A	Reports have been made of elevator malfunction or problems			
☐ Yes ☐ N/A	Annual inspection certificate posted in each elevator car or available for review			
☐ Yes ☐ N/A	Elevator car(s) has a working means of 2-way communication (e.g., telephone), in case of emergency (required in all buildings 3 stories or higher.)			
☐ Yes ☐ N/A	Elevator car(s) has a secondary or emergency means of illumination in case of power failure			

MISCELLANEOUS				
	Description	Corrective Action Needed (Comments)	Date Corrected	By
☐ Yes ☐ N/A	Transparent glass doors marked so that they can be seen			
☐ Yes ☐ N/A	Doorways and thresholds clear of obstructions and trip hazards			
☐ Yes ☐ N/A	Doorways and thresholds that cannot be kept clear of obstructions and trip hazards are posted with warning signs on both sides			

The findings in this report are based on a review of selected portions of Health and Safety Programs and office conditions that were observed during an office inspection. The findings are not, and should not be considered to be, a comprehensive report of all conditions requiring correction. It is the responsibility of the Office Manager to perform ongoing reviews and to correct work site conditions. Corporate Health and Safety staff are available to answer questions and suggest resources to assist in ensuring a safe and healthy workplace.

Revised 1995

3.8 INSTRUCTIONS FOR OFFICE AREA INSPECTIONS

MONTHLY, inspect all office areas for potential hazards using the Office Area Inspection Checklist. Indicate on the cover page that this is a MONTHLY inspection. Fire extinguishers, first aid kits, and bloodborne pathogen kits are included in the inspection process.

Indicate with a checkmark in the far left column that you have inspected each item and found no apparent hazards. If you determine a hazard, do not place a checkmark in the left column but insert the corrective action required, and list who will correct the deficiency. Insert the appropriate date of correction when the correction action is completed. Items that require interaction with building managers or leasing agents, should be assigned to the Administrative Support Leader in the office. Appropriate QAF departments should be involved by the SO for buildings in West Chester. If the item does not apply, please insert N/A, in the far left column.

Retain a copy of each monthly Office Area Inspection Checklist in the Safety Officer files, and ensure that corrective actions are completed in a timely manner. Completed checklists may be disposed after 12 months.

Corrective actions that are not completed within two months must be reported to the Regional Safety Manager. The RSM will then ensure resolution of that corrective action within one month.

Revised 1997

INSTRUCTIONS FOR MONTHLY FIRE EXTINGUISHER INSPECTIONS

Use the Fire Extinguisher Inspection Guide to direct you in what to look for when inspecting fire extinguishers.

Document monthly inspection on the tag attached to each fire extinguisher and on the Office Area Inspection Checklist in the section on Fire Prevention.

Any extinguishers showing defects should be removed and promptly repaired and replaced.

Revised 1997

FIRE EXTINGUISHER INSPECTIONS GUIDE

1. Is the extinguisher clean and well cared for?

2. Has the extinguisher been charged and hydro-statically tested within the prescribed periods and tagged to show the dates?

3. Is the required seal (locking pin) intact?

4. Is the discharge orifice clear and unobstructed?

5. Is there indication that the cap, if any, may be cross threaded on the collar or that threads are corroded?

6. Is the shell of the extinguisher corroded, damaged, or dented in such a way as to suggest possible weakness?

7. Are connections between the hose and the shell and nozzle secure?

8. If the extinguisher is a pump-oriented type, does the pump shaft operate freely?

9. Is the location of the extinguisher readily accessible and plainly indicated so as to be visible at a distance?

10. Is the extinguisher mounted at a convenient height?

11. Is extinguisher protected from environmental stresses, such as temperature below freezing?

12. Is the hanger fastened solidly so that the extinguisher is well supported?

13. Is the extinguisher located too close to the hazard which it is to protect, so that it could not be reached in case of fire?

Any extinguisher showing defects should be removed from service and promptly repaired or replaced.

Revised 1997

FIRE EXTINGUISHER TRACKING

Inspection Name: _____

Location: _____

Extinguisher Number	Type	Location	Last Date Shown On Inspection Tag	Inspected By (Initial/Date)	Condition/Comment (Action Required)

Revised 1997

INSTRUCTIONS FOR FIRST AID AND BLOODBORNE PATHOGENS KITS INSPECTION

If you have a service, such as Zee Medical, that automatically restocks your first aid and bloodborne pathogens kits:

Initially

- Ensure that the service is set up to inspect and to restock all kits regularly.
- Request that the service stock all first aid and BBP kits according to the requirements on the lists.
- Document in the Safety Officer files that you have verified that each kit is stocked to comply with the requirements.

Monthly

- During the monthly office inspection, verify that the service has inspected all first aid and BBP kits.
- Indicate compliance in the Emergency Preparedness Section of the Office Area Inspection Checklist.

If you do not have a service:

Initially

- Ensure that all first aid kits are stocked to meet the requirements on the lists.
- Attach a security seal, if you wish. A broken seal indicates that a closer inspection is required.

Monthly

- Inspect all first aid and BBP kits to verify that all supplies are available as listed on the sheets.
- Replace all missing forms.
- Indicate compliance in the Emergency Preparedness Section of the Office Area Inspection Checklist.

Revised 1997

CONTENTS LIST
FIRST AID KITS OFFICE/LABORATORY

CONTENTS	KIT #1 < 15 EMP.	KIT #2 > 15 EMP.
BAND-AIDS		
- Adhesive Strip, 1" x 3"	20/10	50/20
- Knuckle	20/10	20/10
- Finger Tip, 1-3/4" x 2"	0	20/10
- Finger Tip, 1-7/8" x 3"	10/5	25/5
- Small Strip, 1-1/2" x 7/8"	10/5	10/5
TAPE		
- Adhesive, 1"	1/1	2/1
BANDAGES		
- Gauze (Roller type - Kerlix), 2" & 4"	1/1	2
- Wrap (Self-adhering - Cobane), 3" or 4"	1/1	2/1
- Triangular	1/1	2
- Elastic Ace Wraps, 4"	1/1	2/1
GAUZE PADS		
- 4" x 4"	5/2	10/5
- Non-Stick (Telfa-like)	5/2	10/5
DRESSINGS		
- Eye	2/1	4/1
- Compress	2/1	2/1
ANTISEPTICS/OINTMENTS		
- First Aid Cream Packs	5/3	2/1
- Burn Gel	2/1	10/1
- Hydrocortisone Packs	10/2	10/2
- Sterile Eyewash Solution	2/1	2/1
- Sterile Eye/Skin Wash Sol.	2/1	2/1
- Antiseptic Swabs and/or Betadine Swabs, Box 10	1/1	2/1
OTHER		
- Cold Packs	2/1	4/1
- Ammonia Ampoules	5/3	10/3
- Disposable Blanket	1/1	1/1
- Surgical Gloves	5/2 pr.	10/4 pr.
- CPR Shield ("Mircoshield")	2/1	2/1
- BBP Infection Control Kit	1/1	1/1
- Non-Aspirin Pain Reliever	10/5	25/10
- Goggles (Uvex Ultraspec 1000 or similar) pair	1	1

Revised 1997

CONTENTS LIST
FIRST AID KITS FIELD/VEHICLES

CONTENTS	IDEAL/MINIMUM QUANTITY	
	TRUCKS/VANS	FIELD
BAND-AIDS		
- Adhesive Strip, 7/8" x 3"	20/10	50/20
- Adhesive Strip, 1-1/2" x 7/8"	10/5	50/10
TAPE		
- Adhesive 1"	1/1	2/1
BANDAGES		
- Gauze (Roller type - Kerlix), 2" & 4"	1/1	2/1
- ACE Wraps		2/1
GAUZE PADS		
- 3" x 3"	10/5	20/10
DRESSINGS		
- Eye	2/1	4/2
ANTISEPTICS / OINTMENTS		
- Burn Gel	1/0	10/5
- Sterile Eyewash Solution	1/0	1/0
- Antiseptic Swabs and/or Betadine Swabs, Box 10	1/1	2/1
OTHER		
- Ammonia Ampoules	4/2	5/2
- Surgical Gloves	2/2 pr.	5/2 pr.
- CPR Shield	1/1	2/1
- Non-Aspirin	15/10	25/10
- Insect Sting Kit (crushable ampoules)	1/1	2/1
- Alcohol-Foam Scrub - can	1/1	1/1
- Goggles (UVex Ultraspec 1000 or similar) pair	1/1	1/1

Revised 1997

BLOODBORNE PATHOGNES KIT CONTENTS LIST	
1 ea.	Clean-up Absorbent Pack
1 ea.	Disposable Apron
1 pr.	Disposable Goggles/Safety Glasses
1 ea.	Protective Airway Mask
2 pr.	Latex Disposable Gloves
1 ea.	Scoop
1 ea.	Scraper
2 ea.	Red Biohazard Plastic Bags with Twist Ties
1 ea.	8 oz. Pour Bottle Chlorine Concentrate
3 ea.	Disposable Paper Towels
2 ea.	Chlorhexidine Towelettes or Equivalent
2 ea.	Germicidal Disposable Cloths
1 pr.	Disposable Shoe Covers
1 ea.	Disposable Face Mask

Use above list as a minimum requirement for Bloodborne Pathogens.

Revised 1997

3.9 DRILL RIG INSPECTION CHECKLIST

Answer Yes or No, and make any additional comments you feel are necessary. Potions of this checklist should be filled out during drilling operations.

A. GENERAL HEALTH AND SAFETY

1. Does the Health and Safety Plan (HASP) address drilling hazards? _____
   Comments:_____
   _____

2. Have the hazards of drilling been communicated to all field personnel? _____
   Comments:_____
   _____

3. Have the drillers been informed not to wear rings, loose fitting clothes, straps, draw strings, or other items which may catch in rotating or moving parts? _____
   Comments:_____
   _____

4. Do all field personnel know where the emergency shut off is for the rig? _____
   Comments:_____
   _____

5. Has the drill crew been informed that only qualified drillers may operate the rig? _____
   Comments:_____
   _____

6. Have all field personnel been informed of the location of posted information, i.e., hospitals, emergency phone numbers, evacuation routes? _____
   Comments:_____
   _____

7. Do all field personnel know the location of safety equipment, i.e., first aid kits, fire extinguishers? _____
   Comment:_____
   _____

8. Do drillers know the air-monitoring scheme, i.e., when samples are to be taken? _____
   Comments:_____
   _____

9. Have the geologist and the drill crew established and/or been informed of the method for signaling an emergency? _____
   Comment:_____
   _____

Revised 01/1997

B. PERSONAL PROTECTIVE EQUIPMENT

1. Do drillers have hard hats, safety glasses, and steel toed boots? _____
   Comments:_____
   _____

2. Does this equipment meet ANSI standards?
   Hard hat (ANSI Z81.1) ___; safety glasses (ANSI Z87.1) ___; steel toed boots (ANSI Z41.1) ____
   Comments:_____
   _____

3. Do drillers have hearing protection available? _____
   Comments:_____
   _____

4. Do drillers have the personal protective equipment required in case of upgrade? _____
   Comment:_____
   _____

5. If respirators stored on the rig, are they clean and stored in plastic bags in a dry, safe place such that rubber components are not distorted? _____
   Comments:_____
   _____

6. Do drillers have gloves that are durable and will protect them from the chemical hazards? _____
   Comments:_____
   _____

7. Do the drillers have the correct respirator cartridge, as stated in the HASP? _____
   Comments:_____
   _____

8. Is this equipment used according to OSHA 29 CFR 1910.134? _____
   Comments:_____
   _____

C. HOUSEKEEPING

1. Is there adequate storage area for tools, augers, pipe, etc.? _____
   Comments:_____
   _____

2. Are pipes, augers and rods stacked in an area where they cannot roll or slide? _____
   Comment:_____
   _____

DRILL RIG INSPECTION CHECKLIST - Continued

3. Are work areas and platforms free of tools, debris, and slick substances such as ice, mud, and grease? _____
   Comments:_____
   _____

4. Are controls free of slick substances such as mud, grease, and ice? _____
   Comment:_____
   _____

5. Is gasoline stored in OSHA approved containers? _____
   Comments:_____
   _____

D. MAINTENANCE

1. Do the drillers have a rig inspection program? _____
   Comments:_____
   _____

2. Are the inspections documented? _____
   Comments:_____
   _____

3. How often are the inspections performed? _____
   Comments:_____
   _____

4. Who performs the inspections? _____
   Comments:_____
   _____

5. Do the drillers perform daily checks on the equipment? _____
   Comments:_____
   _____

E. RIG EQUIPMENT

1. Are parking brakes available and in use when the equipment is not in use? _____
   Comments:_____
   _____

2. Are lights, mirrors, windshields and side windows in good condition and operational? _____
   Comments:_____
   _____

Revised 01/1997

DRILL RIG INSPECTION CHECKLIST - Continued

3. Are back-up alarms and warning signals operational? _____
   Comments:_____
   _____

4. Are mud flaps in place and in good condition? _____
   Comments:_____
   _____

5. Are the necessary protective guards maintained in place where injury may result? _____
   Comments:_____
   _____

6. Are cables in good condition and inspected often for, birdcaging, kinks, and flattened areas? _____
   Comments:_____
   _____

7. Are other signs of wear apparent, such as broken or cut wires on the cable? _____
   Comments:_____
   _____

8. Do pulleys operate freely and are cable guards maintained in place? _____
   Comments:_____
   _____

9. Are cable eyes formed and constructed properly? _____
   Comments:_____
   _____

10. Are at least three saddle clips installed and spaced properly, with the "U" section of the clip on the dead end of the rope? _____
    Comments:_____
    _____

11. Are pulleys the proper size for the cable diameter? _____
    Comments:_____
    _____

12. Is the rope to the slide hammer free of worn or burned spots? _____
    Comments:_____
    _____

13. Are hydraulic lines in good condition and fittings tight? _____
    Comments_____
    _____

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14. Are hydraulic slides and guides lubricated adequately and frequently? _____
    Comments:_____
    _____

15. Is the cat head lubricated frequently during use to avoid damaging the rope? _____
    Comments:_____

16. Is the emergency shut off system working properly?
    Comments:_____
    _____

17. Is there a first aid kit with a daily inspection log on the rig? _____
    Comments:_____

18. Is there a 20 B-C fire extinguisher with a current inspection tag available in the work area?
    Comments:_____
    _____

F. CUTTING TORCHES AND WELDING

1. Are drillers who are using cutting/welding equipment properly trained or experienced?
   Comments:_____
   _____

2. Are hoses in good shape, with no cuts or worn spots? _____
   Comments:_____
   _____

3. Are oxygen and acetylene tanks used, stored upright and secured from dropping or falling?
   _____
   Comments:_____
   _____

4. Are oxygen, acetylene and other fuel tanks stored at least 25' apart when not in use? ___
   Comments:_____
   _____

5. Are appropriate eye shades provided? _____
   Comments:_____
   _____

6. Is a wrench provided for operating the valves on the tank? _____
   Comments:_____
   _____

7. Are potentially toxic coatings removed from the materials prior to cutting/welding? ___
   Comments:_____
   _____

8. Is adequate ventilation provided when cutting/welding? _____
   Comments:_____
   _____

9. Are electric cables and connectors in good shape? _____
   Comments:_____
   _____

10. Is appropriate protective clothing worn when welding? _____
    Comments:_____
    _____

11. Are combustible materials kept away from the area while welding activities are in progress? _____
    Comments:_____
    _____

12. Is a Hot Work Permit program in effect when cutting/welding is performed? _____
    Comments:_____
    _____

G. HAND TOOL SAFETY

1. Are hand tools being used for their designed? _____
   Comments:_____
   _____

2. Are tools checked for signs of stress: cracked handles _____; loose handles _____; cracked or mushroomed metal _____; tips or points properly sharpened _____; wrenches _____; worn gripping surfaces _____.
   Comments:_____
   _____

3. Are safety glasses being worn when hand tools that may produce flying fragments are in use? _____
   Comments:_____
   _____

4. Are wrenches being used on nuts and bolts (pliers or pipe wrenches should not be used)? _____
   Comments:_____
   _____

5. Are pipe wrenches and other hand tools clean and in good condition? _____
   Comments:_____
   _____

H. ELECTRICITY AND POWER TOOLS

1. Is low voltage equipment used in tanks and wet area? _____
   Comments:_____

2. Are tools maintained, inspected and in good condition? _____
   Comments:_____
   _____

3. Are electrical tools and instruments approved for use in hazardous areas? _____ If yes, good for Class_____, Division _____, Groups _____
   Comments:_____
   _____

4. Is the insulation on cords in good condition, and plugs unbroken? _____
   Comments:_____
   _____

5. Are extension and power cords protected from vehicular traffic? _____
   Comments:_____
   _____

6. Has the grounding prong on any three-prong plug been cut off? If not, is the extension cord made for a ground plug? _____
   Comments_____
   _____

7. Are guards in place on portable electric tools? _____
   Comments:_____
   _____

I. SAFETY DURING SETUP AND DRILLING

1. Is bannerguard used to delineate the area around the rig (standard is one derrick length)? _____
   Comments:_____
   _____

2. Is the derrick lowered when the rig is moved from one place to another? _____
   Comments:_____
   _____

3. Have overhead and buried utilities been located and marked before drilling begins? _____
   Comments:_____
   _____

Revised 01/1997

DRILL RIG INSPECTION CHECKLIST - Continued

4. Are all personnel (except drillers) cleared from the rear of and the sides of the rig when the derrick is being raised? _____
   Comments: _____
   _____

5. Are the jack pods lowered and leveled before the derrick is lowered? _____
   Comments: _____
   _____

6. Before drilling begins, is the derrick locked into place? _____
   Comments: _____
   _____

7. Does the driller shut down the operation of the rig when he is not at the controls? _____
   Comments: _____
   _____

8. Are open holes covered when left unattended? _____
   Comments: _____
   _____

9. Are drillers restricted from climbing the derrick? _____ If not do they use safety belts or harnesses? ___
   Comments: _____
   _____

10. Are all drilling operations shut down and workers required to be in safe locations during electrical storms? _____
    Comments: _____
    _____

11. Are drillers aware that the derrick must be a minimum of 20' from overhead power lines? _____
    Comments: _____
    _____

12. Have underground surveys been performed before drilling at each location? _____
    Comments: _____
    _____

13. If drilling is allowed after dusk, are 5 footcandles of light provided? _____
    Comments: _____
    _____

14. Is the entire drilling area illuminated so that personnel may see the hazards? _____
    Comments: _____
    _____

NOTE: Drilling after dusk is not recommended. CAR HEADLIGHTS ARE NOT AN ACCEPTABLE MEANS OF ILLUMINATION.

Revised 01/1997

3.10 EQUIPMENT/TRUCKING INSPECTION CHECKLIST

This inspection form is to be filled out at the start of the work shift by the Equipment/Truck Operator to insure that the equipment/truck is safe to operate and is free from apparent damage which could cause failure while in use. Once completed, this form is to be given to the Site Manager to be kept on file on-site. In all cases, consult the manufacturer's data to ensure compliance with all safety inspection criteria which may not be indicated below.

MAKE/DESCRIPTION _____

MODEL/SERIAL _____

	OK	Not OK	Comment And Actions Taken
Brakes	_____	_____	_____
Brake Lights	_____	_____	_____
Reverse Signal Alarm	_____	_____	_____
Horn	_____	_____	_____
Tires	_____	_____	_____
Steering	_____	_____	_____
Seat Belts	_____	_____	_____
Operating Controls	_____	_____	_____
Fire Extinguisher	_____	_____	_____
Lights	_____	_____	_____
Defroster	_____	_____	_____
Mirrors	_____	_____	_____
Instruments	_____	_____	_____
Coupling Devices	_____	_____	_____
Windshield/Window Glass	_____	_____	_____
Windshield Wiper	_____	_____	_____
Mud Flaps/Rock Guards	_____	_____	_____
Exhaust System	_____	_____	_____
Hitches & Safety Cables	_____	_____	_____
Hydraulic Lines/Air Hoses	_____	_____	_____
Engine Oil Level	_____	_____	_____
Roll-Over Protection/ Emergency Equipment	_____	_____	_____

Odometer: _____ Hour Meter: _____

Fuel Level: _____

Inspector Name/Signature: _____

Date: _____ Time: _____

Revised 01/1997

HASP: Field OPs

FLD 01 OCCUPATIONAL NOISE AND HEARING CONSERVATION

(Final revision 11/8/1999)

Return to top

GENERAL

Noise is defined as unwanted sound. Noise can cause sudden traumatic temporary or permanent hearing loss, long term slowly occurring sensory-neural and irreversible hearing loss, disruption of communication, and masking of warning devices and alarms. Increased stress levels and effects on the cardiovascular and nervous systems have been documented as additional concerns.

The goal of this operating practice is to reduce and potentially eliminate hazardous levels of noise exposure.

REFERENCES

29 CFR 1910.95

RESPONSIBILITIES

Project Manager or Supervisor: The Project Manager or employee's supervisor shall ensure that WESTON and subcontract personnel under their control comply with the requirements of this procedure and have the necessary resources to assure compliance. The Project Manager or Supervisor will ensure that hazard assessment, monitoring and control procedures have been implemented.

Safety Officer: The safety officer (site, project or region) shall assist the Project Manager or Supervisor in understanding the technical requirements of this practice.

The Corporate Health and Safety (CHS) Director: The CHS Director or his designees (e.g., safety professionals, safety officers, division safety managers, or operations health and safety group) will provide assistance with interpretations of this practice. The CHS Director will ensure periodic evaluation of this operating practice through practice review and inspections.

Occupational Medical Provider (OMP): WESTON's OMP will assist in compliance with this practice through evaluation of clinics, verification of baseline exams and annual employee audiogram evaluation. The OMP will advise the Safety Officer and, if necessary, the CHS Director of any problems associated with medical compliance or occupationally related hearing loss in workers.

Employees: All affected employees are responsible for complying with the requirements of this practice. Any concerns or questions regarding compliance is to be brought the attention of the Safety Officer, the Project Manager, or the Supervisor.

Recognition and Risk Assessment

Employee noise exposure is expressed as an eight-hour time-weighted average (full shift exposure) in decibels (dB) on the "A-scale" (dBA). This number is to be compared to the Occupational Safety and Health Administration's Permissible Exposure Limit (PEL) which is an 8-hour time-weighted average (TWA) of 90 dBA, and the OSHA Action Level (AL) which is 85 dBA. Table G-16 in 29 CFR 1910.95 provides information regarding time-equivalent PELs.

The PEL is a limit which should not be exceeded, and the AL is a noise level threshold which when exceeded obligates the employer to establish a Hearing Conservation Program (HCP). The HCP includes baseline and annual hearing tests, and hearing conservation training. Whenever there is a reasonable possibility of employee noise exposure over 85 decibels, the affected employee is enrolled in the HCP.

The need for noise monitoring equipment, noise dosimeters or hearing protection devices must be addressed in the planning stages of a project. WESTON personnel and WESTON subcontractors are to wear hearing protection devices when required and where signs are posted requiring their use.

Some of the sources of noise at hazardous materials sites, demolition operations, construction and industrial sites which can cause hearing damage are: compressor motors, drill rig engines, hammer blows (such as from a split spoon), compressor motors, compressed air, and heavy equipment. Examples of approximate noise levels from various activities are as follows:

- Rock Drilling: up to 115 dBA
- Chain Saws: up to 125 dBA
- Abrasive Blasting: up to 110 dBA
- Heavy Equipment: 95 to 110 dBA
- Demolition: up to 117 dBA
- Needle Guns: up to 112 dBA
- Riveter/Chipper: up to 120 dBA
- Noisy Factory: up to 90 dBA
- Noisy Office: 70 to 80 dBA
- Conversational Speech: 60 dBA

Noise Evaluation and Surveillance Procedures

Noise exposure assessment is performed only by qualified personnel with properly calibrated and functional noise measuring equipment. If the HASP or the Safety Officer indicate that the site, or activity, requires an instrumentation survey then the area will be screened with an A-weighted sound level meter (Area Monitoring). If deemed necessary a more in depth evaluation utilizing a noise dosimeter may be performed (Personnel Monitoring). Both types of monitoring, if needed, will be accomplished in accordance with requirements established in 29 CFR 1910.95(d).

Long-term work efforts at fixed locations (e.g., water treatment plants, incinerators, etc.) will require an evaluation of noise levels utilizing instrumentation. Re-monitoring may be necessary when changes in equipment, processes or activities result in modification of the noise level.

If impact noise is present, the peak noise levels and the frequency of the impacts should be determined. Both OSHA and the American Conference of Governmental Industrial Hygienists (AGCIH) recommend certain limits to impact noise which depend on the noise intensity and frequency of the impacts. These resources and/or qualified personnel should be consulted if questions arise regarding impact or impulse noise.

Noise Control Methods

Engineering Controls

The primary means of reducing or eliminating personnel exposure to hazardous noise is through engineering controls. Engineering controls are defined as any modification or replacement of equipment, or related physical change at the noise source or along the sound transmission path that will reduce the noise level to the employees ear. Engineering controls include items such as; mufflers on heavy equipment or motors, sound baffles, and enclosures.

Administrative Controls

Administrative controls are defined as changes in the work schedule or operations which reduce noise exposure. These controls include increasing worker distance from the noise source and rotation of jobs so that time limits of exposure are reduced.

Administrative time control is not a preferable method for preventing noise exposure since extreme noise for a short duration can cause severe, permanent hearing loss. Administrative controls may be utilized in accordance with the TWA Tables (see 29 CFR 1910.95, Table G-16). Administrative controls may not be utilized for exposures greater than 115 dBA, regardless of the exposure time.

Hearing Protection

Hearing protection devices are utilized whenever engineering controls prove to be infeasible or cost prohibitive. Various types of ear muffs and ear plugs are available. Hearing protector attenuation is intended to reduce employee exposures below 85 dBA for employees with standard threshold shifts and below 90 dBA for all other employees.

Hearing protection devices are strongly recommended in any noisy environment, but are mandatory in the following situations:

- The eight hour average may equal or exceed 90 decibels.
- Any employee exposed to greater than or equal to 85 decibels and who have experienced a standard threshold shift (STS) in their hearing.
- Any noise equal to greater than 115 decibels impact, continuous or intermittent.
- Anywhere a "HEARING PROTECTION REQUIRED" sign is posted. These signs are to be posted in all mandatory situations listed above.

In the absence of sound level measuring instrumentation, any noise preventing normal vocal discussion between two individuals at arms length distance ("arms-length rule") will dictate the need for hearing protection. WESTON guidelines require the use of hearing protection on an immediate basis under the "arms-length rule". Exceptions may be granted based upon task and duration.

Not all hearing protection devices have the same noise reduction rating (NRR). Verification of all NNR values must be made by referring to the manufacturers' specifications.

The proper hearing protection is selected using results from a properly calibrated sound level meter in the following manner. The NRR of the device chosen is reduced by subtracting. Then this resulting number is subtracted from the noise level in dBA (for example: if the noise reading is 100 dBA, and the ear plugs selected have a NRR of 27. Subtracting 7 from 27 equals 20. Subtracting 20 from 100 equals 80. The attenuated sound level to the wearer is 80). Appendix B of 29 CFR 1910.95 provides information on attenuation adequacy using other monitoring devices or scales.

Hearing protection must attenuate employee exposure to an 8-hour TWA of 90 dBA or less. WESTON will strive to accomplish an attenuation of 85 dBA or less. For any employee diagnosed with a standard threshold shift, the attenuation must be 85 dBA or less.

Additional information regarding the selection, use, maintenance, and control of hearing protection devices is provided in the WESTON Personnel Protective Equipment Program.

Medical Surveillance

Compliance with the Hearing Conservation Program (HCP) component of 29 CFR 1910.95 is required whenever an employee's exposure to noise in excess of 85 dBA occurs. As such, field employees whose job descriptions require work with drill rigs, heavy construction equipment or noisy client operations would be candidates for the HCP and medical surveillance requirements thereof. Supervisors of any employees not meeting the categories above (e.g., treatment plant operations, print shop, maintenance personnel) are required to determine the need for those employees to participate in the HCP by performing noise surveys, and advise their safety officer who will in turn notify the Occupational Medical Provider.

WESTON's Occupational Medical Provider will make the final determination of employee involvement in the medical surveillance component of the HCP.

Audiometric testing is performed annually to evaluate the hearing of all individuals who are routinely exposed to 8 hour TWA exposures of 85 dBA or greater (including compliance with the "arms-length rule"). By evaluating the hearing of these individuals, the overall effectiveness of the Occupational Noise and Hearing Conservation Program can be systematically monitored. WESTON's Occupational Medical Provider is responsible for assuring local clinic compliance with the audiometric testing component of the standard.

Training

Initial and annual training shall be given to each employee included in the Hearing Conservation Program. Training will address the following:

The effects of noise on hearing.

- The purpose of hearing protection, advantages, disadvantages, attenuation of various types, and the selection, fitting, use, and care of protectors.
- The purpose of audiometric tests and explanation of test procedures.
- Recognition of hazardous noise.

WESTON's initial and refresher courses under 29 CFR 1910.120 (Hazwoper) are utilized to deliver these training obligations. Alternative training will be given to employees who are included in the HCP but who are not trained in accordance with Hazwoper requirements,.

Program Evaluation

Periodic program evaluations will be conducted to assess compliance with 29 CFR 1910.95 and this operating practice. The CHS Director (or his designee) is responsible for reviewing this practice on an annual basis. WESTON's Occupational Medical Provider is responsible for assisting in this evaluation by providing information relative to employee exposure and medical surveillance data.

Recordkeeping

Employee exposure measurements are retained for a minimum of two years and audiometric test records are retained for the duration of the employee's employment, plus thirty years.

FLD 02 INCLEMENT WEATHER

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GENERAL

REFERENCES

Related FLD OPS:

FLD05 – Heat Stress Prevention and Monitoring
FLD06 – Cold Stress
FLD25 – Working at Elevations
FLD26 – Ladders
FLD27 – Scaffolds

PROCEDURE

Hot weather (ambient temperatures over 70°F), cold weather (ambient temperatures below 40°F), rain, snow, ice, and lightning are examples of inclement weather that may be hazardous or add risk to work activities. Heat stress and cold stress are covered under separate operating procedures.

Extremes of heat, cold, and humidity, as well as rain, snow, and ice, can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials.

Heat

Additional examples and protection from heat stress are addressed in WESTON Safety Procedure FLD05. Hot, dry weather increases risk of soil drying, erosion, and dust dispersion, which may present or increase risk of exposure and environmental impact from toxic hazards. Hot weather will increase pressure on closed containers and the rate of volatilization, thereby potentially increasing the risk of exposure to toxic, flammable, or explosive atmospheres.

Rain, Wet Weather, and High Humidity

Rain and wet conditions increase slipping and tripping hazards, braking distances of vehicles, and the potential for slippage or handling difficulties for devices such as augers and drills. Rain fills holes, obscures trip and fall hazards, and increases risk of electrical shock when working with electrical equipment. Changes in soil conditions caused by rain can impact trenching and excavating activities, creating the potential for quicksand formation, wall collapse, and cave-in. Vehicles become stuck in mud, and tools and personnel can slip on wet surfaces.

Rain and wet conditions may decrease visibility (especially for personnel wearing respiratory protection) and limit the effectiveness of certain direct-reading instruments (e.g., photoionization detectors [PIDs]).

Cold, Snow, and Ice

In addition to cold stress, which is covered in WESTON field procedure FLD06, cold weather affects vehicle operation by increasing difficulty in starting and braking. Ice, frost, and snow can accumulate on windows and reduce vision.

Cold, wet weather can cause icing of roadways, driveways, parking areas, general work places, ladders, stairs, and platforms. Ice is not always as obvious to see as snow or rain, and requires special attention, especially when driving or walking.

Snow and ice increase the risk of accidents such as slipping when walking, climbing steps and ladders, or working at elevation, and the risk of accidents when driving vehicles or operating heavy equipment. Heavy snow and ice storms may cause electric lines to sag or break, and the use of electrical equipment in snow increases the risk of electric shock. Snow can hide potholes and mud, which can result in vehicles getting stuck or persons falling when stepping into hidden holes. Snow also may cover water, drums or other containers, sharp metal objects, debris, or other objects that can cause falls or punctures.

Personnel performing activities that require working over ice should be aware of minimal ice thickness safety guidelines as follows:

- 4-inch minimum: activities such as walking or skating.
- 6-inch minimum: activities such as snowmobiling or the use of equipment with the same weight and cross-sectional area as a snowmobile.

Personnel should always be aware that these measurements are under ideal conditions and that snow cover, conditions on rivers, ponds, or lakes with active currents, and other environmental factor impact the safety of working on ice. Clear ice typically is the strongest, while ice that appears cloudy or honeycombed is not as structurally strong. Measurements made by drilling or cutting through the ice should be made every few feet to verify safe conditions. Under no circumstances should WESTON personnel operate motor vehicles such as cars or trucks on ice.

Provisions for rescue (e.g., ladders or long poles and effective communications) must be available at the work site.

Lightning

Lightning represents a hazard of electrical shock that is increased when working in flat open spaces, elevated work places, or near tall structures or equipment such as stacks, radio towers, and drill rigs. Lightning has caused chemical storage tank fires and grass or forest fires. Static charges associated with nearby electrical storms can increase risk of fire or explosion when working around flammable materials, and can adversely affect monitoring instruments.

Recognition and Risk Assessment

Few Occupational Safety and Health Administration (OSHA) regulations apply to the conditions covered in this procedure; however, under specific standards (e.g., Construction Industry, Subpart P, Excavations) and the OSHA General Duty Clause, inclement weather hazards must be addressed in safety programs.

Heat, rain, cold, snow, ice, and lightning are natural phenomena that complicate work activities, and add or increase risk. The potential for physical hazards must be considered for tasks that expose personnel to inclement weather. Risk assessment can be accomplished during the planning stages of a project by developing a task risk analysis for the most likely inclement weather conditions that may be encountered, i.e., rain and lightning in late spring, summer, and early fall, or lightning prone areas; cold, snow, and ice in winter. The SHSC must make decisions on the proper safety procedure and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or the risk is too great.

A pre-site activity risk assessment must be completed when inclement weather occurs. Weather conditions that affect instruments and PPE function must be conveyed to site workers. All personnel should monitor function and integrity of PPE and be alert to changing weather conditions. A decision must be made on the proper safety procedures to use if work must continue, or to stop work if the risk is too great. The Appropriate Safety Professional **must be notified of all instances of the need to stop work for safety reasons, including inclement weather**.

Prevention and Protection Programs

Procedures applicable to inclement weather include the following:

Monitoring equipment and PPE must be maintained in proper working order and used according to manufacturers' instructions.

Walkways, stairs, ladders, elevated workplaces, and scaffold platforms must be kept free of mud, ice, and snow.

Vehicles used in rain or cold weather must have windshield wipers and defrosters, and windows must be kept clear of obstruction.

Employees must be protected from airborne contaminants using engineering controls such as wetting dry soil to prevent particle dispersion, and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed personal protective equipment (PPE).

Required conformance with traffic laws, including maintaining speed within limits safe for weather conditions, and wearing seat belts at all times.

Using a walking stick or probe to test footing ahead of persons walking where there is standing water, snow, or ice to protect the walker against stepping into potholes or onto puncture hazards, buried containers, or other potential structurally unsound surfaces.

Prior to using vehicles or equipment in off-road work, walking the work area or intended travelway when puddles or snow may obscure potholes, puncture hazards, or buried containers, or other potential structurally unsound surfaces.

Arranging to have winches, come-alongs, or other mechanical assistance available when vehicles are used in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load, and be inspected regularly and before use to ensure safety. **Manually pushing stuck vehicles is to be avoided.**

Monitoring wind shifts and velocity where change may result in dispersion of airborne contaminants into work area.

Prior to working in areas or beginning projects during times when there is an increased likelihood of lightning or the potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes, including:

a) Checking with client management to determine if there is any pattern or noted conditions that predict lightning or if there are structures that are prone to lightning strikes. Arrange for client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.

b) Monitoring weather reports.

c) Noting weather changes and conditions that produce lightning.

d) Stopping work in open areas, around drill rigs or other structures that may attract lightning, on or in water and in elevated work places when lightning strikes are sighted or thunder is heard near a work site.

e) Ensuring all personnel are provided with safe areas of refuge. Keep personnel from standing in open areas, under lone trees, or under drill rigs.

FLD 05 HEAT STRESS PREVENTION AND MONITORING

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GENERAL

Heat stress may occur at any time work is performed at elevated temperatures. Wearing chemical protective clothing often decreases natural body heat loss and increases the risk of heat stress.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur, with symptoms ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration or dexterity) to fatal. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, regular monitoring and other preventive measures are vital to ensure worker safety.

Employees who are taking prescription or over-the-counter medications should consult with their personal physician prior to working in high-temperature environments.

REFERENCES

OSHA 29 CFR 1910 and 1926

Related FLD OPS:

FLD02 – Inclement Weather
FLD03 – Hot Processes – Steam
FLD08 – Confined Space Entry
FLD36 – Welding, Cutting and Burning
FLD37 – Pressure Washing

APPENDICES

A Common Heat Stress Disorders and Their Prevention and Treatment

PROCEDURE

Recognition and Risk Assessment

In the planning stages of a project, the potential for heat stress disorders must be considered as a physical hazard in the site-specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely heat stress disorders that may occur.

The SHSC must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or the risk is too great. In addition, all site personnel must be aware of these symptoms in both themselves and their co-workers.

Four common heat stress disorders and their associated prevention and treatment methods are provided in Appendix A.

Prevention and Protection Programs

Heat stress is affected by several interacting factors including, but not limited to, age, obesity, physical condition, substance abuse, level of personal protective equipment worn, and environmental conditions (temperature, shade, and humidity). Site workers must learn to recognize and treat the various forms of heat stress. The best approach is preventive heat stress management such as the examples given below.

Have workers drink 16 ounces of water before beginning work, at established breaks, and in the morning or after lunch. The body's normal thirst mechanism is not sensitive enough to ensure body fluid replacement, therefore, pre- and post-work fluid intake is necessary. Under heavy work and heat conditions, the body may lose up to 2 gallons of fluids per day. In order to prevent heat stress symptoms, the individual must ensure replacement of this moisture.

Provide disposable cups that hold about 4 ounces, and water that is maintained at 50 to 60°F. Have workers drink 16 ounces of water before beginning work, and a cup or two at each break period. Provide a shaded area for rest breaks. Discourage the intake of caffeinated drinks during working hours. Monitor for signs of heat stress.

Encourage workers to maintain a good diet during these periods. In most cases, a balanced diet and lightly salted foods should help maintain the body's electrolyte balance. Bananas are especially good for maintaining the body's potassium level. The most important measure to prevent heat-related illness is adequate fluid intake. Workers should drink 1/2 to 1 quarts of liquids per hour in high heat conditions. Most of this liquid should be water.

If utilizing commercial electrolyte mixes, double the amount of water called for in the package directions. Indications are that "full-strength" preparations taken under high heat stress conditions may actually decrease the body's electrolytes.

Acclimate workers to site work conditions by slowly increasing workloads, i.e., do not begin work activities with extremely demanding tasks. Rotate shifts of workers who are required to wear impervious clothing in hot weather. In extremely hot weather, conduct field activities in the early morning and evening.

Provide cooling devices to aid natural body heat regulation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear, which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.

Ensure that adequate shelter is available to protect personnel against heat and direct sunlight, which can decrease physical efficiency and increase the probability of heat stress. If possible, set up the command post in the shade.

Good hygienic standards must be maintained by frequent showering and changes of clothing. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

Heat Stress Monitoring and Work Cycle Management

When strenuous field activities are part of on-going site work conducted in hot weather, the following guidelines should be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures should be instituted when the temperature exceeds 70°F and the tasks/risk analysis indicates an increased risk of heat stress problems. Consult the HASP and a safety professional (e.g., Division safety manager, safety officer) if questions arise as to the need for specific heat stress monitoring. In all cases, the site personnel must be aware of the signs and symptoms of heat stress and provide adequate rest breaks and proper aid as necessary.

Measure Heart Rate – Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the rest period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats per minute.

Measure Body Temperature – When ambient temperatures are over 90°F, body temperatures should be measured with a clinical thermometer as early as possible in the rest period. If the oral temperature exceeds 99.6°F (or 1 degree change from baseline) at the beginning of the rest period, the following work cycle should be shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F (or 1 degree change from baseline). Under no circumstances should a worker be allowed to work if their oral temperature exceeds 100.6°F.

Measure Body Water Loss – Body water loss greater than 1.5% of total body weight is indicative of a heat stress condition. Body weight is measured before personal protective equipment (PPE) is donned and after the PPE is removed following a work cycle. Body water loss can be measured with an ordinary bathroom scale, however, the scale must be sensitive to one-half pounds increments. A worker is required to drink additional fluids and rest if their body water loss is greater than 1.5%.

Note: For purposes of this operating practice, a break is defined as a 15-minute period and/or until an individual's vital signs are within prescribed guidelines.

A physiological monitoring schedule is determined by following the steps below:

Measure the air temperature with a standard thermometer.

Estimate the fraction of sunshine by judging what percent the sun is out (refer to Table 1).

Calculate the adjusted temperature based on the following formula:

Adjusted Temperature = Actual Temperature + 13 X
(fraction of the percent sunshine factor)

Using Table 2, determine the physiological monitoring schedule for fit and acclimated workers.

The length of work period is governed by frequency of physiological monitoring (Table 2). The length of the rest period is governed by physiological parameters (heart rate and oral temperature). For example, site personnel anticipate wearing level C (impermeable clothing) during site activities.

The air temperature is 80°F and there are no clouds in the sky (100% sunshine). The adjusted temperature is calculated in the following manner:

Adjusted Temperature (Adj T °F) = Actual Temperature (Amb T °F) + (13 x fraction of the percent sunshine factor).
Adj T °F = 80°F + (13 x 1.0)
Adj T °F = 93°F

Using Table 2, the pulse rate, oral temperature and body water loss monitoring would be conducted after each 60 minutes of work. The adjusted temperature may need to be redetermined if the percent sunshine and ambient temperature changes drastically during site work.

If an individual's heart rate exceeds 110 beats per minute at the beginning of the rest period, that individual will continue to rest until his or her heart rate drops to baseline; the next work period is then decreased by 33%.

TABLE 1

PERCENT SUNSHINE FACTORS
HEAT STRESS PREVENTION AND MONITORING

Percent Sunshine (%)	Cloud Cover	Sunshine fraction
100	No cloud cover	1.0
50	50% cloud cover	0.5
0	Full cloud cover	0.0

TABLE 2

PHYSIOLOGICAL MONITORING SCHEDULE
HEAT STRESS PREVENTION AND MONITORING

Adjusted Temperature	Level D (Permeable clothing)	Level C, B, or A (Nonpermeable clothing)
90°F (32.2^{o}C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5^{o}F (30.8^{o}-32.2^{o}C)	After each 60 minutes of work	After each 30 minutes of work
82.5^{o}-87.5^{o}F (28.1^{o}-32.2^{o}C)	After each 90 minutes of work	After each 60 minutes of work
77.5^{o}-82.5^{o}F (25.3^{o}-28.1^{o}C)	After each 120 minutes of work	After each 90 minutes of work
72.5^{o}-77.5^{o}F (22.5^{o}-25.3^{o}C)	After each 150 minutes of work	After each 120 minutes of work

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APPENDIX A

COMMON HEAT STRESS DISORDERS AND THEIR PREVENTION AND TREATMENT

Heat Rash

Heat rash is caused by continuous exposure to heat and humidity, and is aggravated by chafing clothes. The condition decreases an individual's ability to tolerate heat and can be extremely uncomfortable.

Symptoms – Mild red rash, especially in areas of the body that come into contact with protective gear.

Treatment – Decrease amount of time spent working in protective gear and provide body powder to help absorb moisture and decrease chafing.

Heat Cramps

Heat cramps are caused by inadequate electrolyte intake. The individual may be receiving adequate water, however, if not combined with an adequate supply of electrolytes, the blood can thin to the point where it seeps into the active muscle tissue, causing cramping.

Symptoms – Acute painful spasms of voluntary muscles, most notably the abdomen and extremities.

Treatment – Move the victim to a cool area and loosen clothing. Have the victim drink 1 to 2 cups of lightly salted water or diluted commercial electrolyte solution immediately, and then every 20 minutes thereafter until symptoms subside. Electrolyte supplements can enhance recovery (e.g., Gatorade, Quench) however, it is best to double the amount of water required by the dry mix package directions or add water to the liquid form.

Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. The condition is much less dangerous than heat stroke, but it nonetheless must be treated.
Symptoms – Pale, clammy, and moist skin, profuse perspiration, and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, and may feel dizzy.

Treatment – Move the victim to a cool, air-conditioned or temperature-controlled area, loosen clothing, place in a position with the head lower than the feet (shock prevention), and allow the victim to rest. Consult a physician, especially in severe cases. Have the victim drink 1 to 2 cups of water immediately, and every 20 minutes thereafter until symptoms subside.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the body's heat regulating mechanisms, i.e., the individual's temperature control system (sweating) stops working correctly. Body temperature rises so high that brain damage and death may result if the person is not cooled quickly.

Symptoms – Red, hot, dry skin (although the person may have been sweating earlier); nausea, dizziness, confusion, extremely high body temperature, rapid respiratory and pulse rate, unconsciousness or coma.

Treatment – Remove the victim from the source of heat and cool the victim quickly. If the body temperature is not brought down quickly, permanent brain damage or death may result. Soak the victim in cool (not cold) water, sponge the body with cool water, or pour water on the body to reduce the temperature to a safe level (less than 102°F). Monitor the victim's vital signs and obtain immediate medical help. Do not give the victim coffee, tea, or alcoholic beverages.

FLD 06 COLD STRESS

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GENERAL

REFERENCES

Related FLD OPS:

FLD02 – Inclement Weather
FLD07 – Wet Feet
FLD15 – Remote Areas
FLD17 – Diving
FLD18 – Using Boats
FLD19 – Working Over Water
FLD25 – Working at Elevations

PROCEDURE

Persons working outdoors in low temperatures (below 40°F), and especially at or below freezing, are subject to cold stress. Exposure to extreme cold for a short time can cause severe injury to the surface of the body, or result in profound generalized cooling which, unchecked, could ultimately cause death. Areas of the body that have high surface-area-to-volume ratios, such as fingers, toes, and ears, are the most susceptible.

Chemical protective clothing generally does not afford protection against cold stress. In many instances, it increases susceptibility. Chemical hazard site workers must learn to dress carefully to provide both chemical protection and thermal insulation while not dressing so warmly that exercise or strenuous activity will result in cold stress.

Body heat is conserved through the constriction of surface blood vessels. This constriction reduces circulation at the skin layers and keeps blood nearer the body core.

Loss of body heat can occur through:

1. Respiration – In extreme cold, cover the mouth and nose with wool or fur to "pre-warm" the air you breath.

2. Evaporation – Wear layered clothing, and remove outer layers prior to overheating to avoid soaking clothing with perspiration. Replace layers prior to becoming chilled. Wear clothing that will "breath" or allow water vapor to escape to reduce the cooling effect of evaporation.

3. Conduction – Sitting on snow, touching cold equipment, and working in the rain are examples of how heat can be lost by conduction. A great deal of body heat is lost rapidly when a person becomes wet. Hypothermia from immersion in water has resulted in death at temperatures of 40°F or lower. Perspiration or rain should never be allowed to saturate clothing; such soaking will seriously reduce the insulative properties of the clothing, in addition to increasing heat loss. Most clothing loses approximately 90 percent of its insulating properties when wet.

4. Radiation – The greatest amount of body heat is lost from uncovered surfaces of the body, especially the head, neck, and hands. Covering these areas is, therefore, extremely important.

5. Convection – The body continually heats a thin layer of air next to the skin. As long as this warm air is retained next to the body, it will remain warm. If this warm air is removed by air currents (wind), the body will be cooled attempting to rewarm the surface air. The primary function of clothing is to retain this warm surface layer of air while allowing water vapor to pass through. Ensure that clothing remains secure around the body, especially at the neck and waist. Wind chill or equivalent chill temperature indices describe the chilling effect of moving air in combination with low temperature.

Two major factors that influence the potential of cold injury are ambient temperature and wind velocity. The term wind chill is used to describe the chilling effect of moving air in combination with low temperature. Additionally, water conducts heat 240 times faster than air; thus, the body cools suddenly when protective equipment is removed if the clothing underneath is perspiration-soaked.

Tables 1 and 2 should be consulted to adjust working schedules for wind chill conditions. These tables are meant as guides only; ambient temperatures and wind conditions should be monitored frequently and work schedules adjusted as required. Workers' physical symptoms or condition will also be an indicator of the need to modify work schedule.

Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for cold stress disorders must be considered as physical hazards in the site-specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely cold stress disorders which may occur. The SHSC must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or the risk is too great. Two common cold stress disorders and treatment methods are identified below.

Frostbite

Local injury resulting from cold is included in the generic term frostbite. By definition, frostbite is the freezing of tissue, however, several stages are recognized, based on the degree of injury.

Frostbite most commonly affects the toes, fingers, and face, and occurs when an extremity loses heat faster than it can be replaced by the circulating blood. Frostbite may also result from direct exposure to extreme cold or high wind, as happens with the nose, ears, and hands. Feet may freeze because of the conduction of heat away from the skin's surface caused by damp socks and shoes.

Frostbite of the extremities can occur in three forms:

- Frost nip or incipient frostbite is characterized by sudden blanching or whitening of skin.
- Superficial frostbite is characterized by skin with a waxy or white appearance that is firm to the touch, but the tissue beneath is resilient.
- Deep frostbite is characterized by tissues that are cold, pale or darkened, and solid.

Treatment for frostbite:

- Move the victim indoors and/or away from additional exposure to cold, wet, and wind.
- Superficially frostbitten areas are best warmed by placing them next to warm skin. The basic tenant to rewarming frostbitten areas is to not raise the temperature much above that of the body. The abdomen and the armpit are body areas that can be used to rewarm frostbitten areas. Water at 99° to 104°F can be used. Avoid the use of fires, hot water, or external heaters to warm frostbitten areas.
- Give a warm drink (water or juices, **not** coffee, tea or alcohol). Do not allow the victim to smoke.
- If using water to rewarm the affected areas, keep the frozen parts in warm water until all paleness has turned to pink or burgundy red, but no longer. Remember, the tissue will be very painful as it thaws.
- After rewarming, elevate the area and protect it from further injury.
- Do not break blisters.
- Use sterile, soft, dry material to cover the injured areas.
- Keep victim warm and obtain medical care as necessary.
- Do **not** rub the frostbitten part (this may cause gangrene).
- Do **not** use ice, snow, gasoline or anything cold on the frostbitten area.
- Do **not** use heat lamps or hot water bottles to rewarm the frostbitten area.
- Do **not** place the frostbitten area near a hot stove.

Hypothermia

Systemic hypothermia occurs when body heat loss exceeds body heat gain and the body core temperature falls below the normal 99°F. While many hypothermia cases are caused by extremely cold temperatures, most cases develop in air temperatures between 30° and 50°F, especially when compounded with water immersion or soaking, and windy conditions.

Remember that the victim of hypothermia may not know, or refuse to admit, that he or she is experiencing hypothermia. All personnel must be observant for these signs for themselves and for other team members. Hypothermia can include one or more of the following symptoms.

- Uncontrollable shivering.
- Vague, slow, slurred speech.
- Irrational actions.
- Memory lapses.
- Incoherence.
- Fumbling hands, frequent stumbling, lurching gait.
- Apathy, listlessness, and sleepiness' inability to get up after resting.
- Unconsciousness, glassy stare, slow pulse and slow respiration.
- Death.

Below the critical body core temperature of 95°F, the body cannot produce enough heat by itself to recover. At this point, emergency measures must be taken to reverse the drop in core temperature. The victim may slip into hypothermia in a matter of minutes and can die in less than 2 hours after the first signs of hypothermia are detected. Treatment and medical assistance are critical.

Treatment for hypothermia:

- Prevent further heat loss by moving the person to a warmer location out of the wind, wet, and cold.

- Remove cold, wet clothing. If necessary, based upon the victim's condition, external sources of heat (e.g., warm blankets, warm water baths, or body contact) may be necessary to rewarm the victim.

- If the victim is conscious, provide warm liquids, candy, or sweetened foods. Carbohydrates are the food most quickly transformed into heat and energy. Do not give alcohol or caffeine.

- Keep the victim awake, monitor ABCs, perform first aid as appropriate, and obtain medical assistance soon as possible.

Prevention and Protection Programs

Site workers must learn to recognize and treat the various forms of cold stress. The best approach is preventive cold stress management, such as the following:

- Wear loose, layered clothing, masks, woolen scarves, and hats in extreme cold weather.

- Keep clothes dry by wearing water and wind resistant clothing and footwear.

- Eat well-balanced meals, ensure adequate intake of liquids and avoid alcoholic beverages. Dehydration increases risk of cold stress.

- Have warm shelter available and implement work-rest schedules.

- Monitor yourself and others for changes in physical and mental condition.

- If wearing a face protector, remove it periodically to check for frostbite.
- Never touch cold metal with bare hands.

The following guidelines should be used when working in air temperatures below 40°F.

- When cold surfaces below –7°C (19.4°F) are within reach, a warning should be given to each worker by the SHSC to prevent inadvertent contact by bare skin.
- If the air temperature is –17.5°C (0°F) or less, the hands should be protected by mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

Provisions for additional total body protection are required if work is performed in an environment at or below 4°C (39.2°F). Workers should wear cold-protective clothing appropriate for the level of cold and physical activity:

- If the air velocity at the job site is increased by wind, draft, or artificial ventilation, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.
- If only light work is involved and if the worker's clothing may become wet on the job site, the outer layer of the clothing in use may be of a type impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outerwear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation to prevent wetting of inner layers by sweat. If work is done at normal temperatures or in a hot environment before entering the cold area, the employee should make sure that clothing is not wet as a consequence of sweating. If clothing is wet, the employee should change into dry clothes before entering the cold. Workers should change socks and any removable felt insoles at regular daily intervals, or use vapor barrier boots. The optimal frequency of change should be determined empirically and will vary individually and according to the type of shoe worn and how much the individual's feet sweat.
- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.
- Workers handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 4°C (39.2°F) should take special precautions to avoid soaking clothing or gloves with the liquid because of the added danger of cold injury due to evaporative cooling.

Work/Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below –7°C (19.4°F), heated warming shelters, tents, cabins, and break rooms should be made available nearby. Workers should be encouraged to use these shelters at regular intervals, frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter. When

entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation, or the worker should change into dry clothing to avoid returning to work in wet clothing. Dehydration, or the loss of body fluids, occurs insidiously in a cold environment and may increase the susceptibility of workers to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to provide caloric intake and fluid replacement. The intake of caffeinated drinks should be limited because of the diuretic and circulatory effects.

For work practices at or below –12°C (10.4°F) ECT, the following should apply:

- The worker should be under constant protective observation (buddy system or supervision).
- The work rate should not be so high as to cause heavy sweating that will result in wet clothing. If heavy work must be done, rest periods must be taken in heated shelters and opportunities to change into dry clothing should be provided.
- New employees should not be required to work full-time in the cold during the first days of employment until they become accustomed to the working conditions and the use of required protective clothing.
- The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the worker.
- The work should be arranged in such a way that sitting or standing still for long periods is minimized. The worker should be protected from drafts to the greatest extent possible.
- The workers should be instructed in safety and health procedures. The training program should include, as a minimum, instruction in:
  - Proper rewarming procedures and appropriate first aid treatment.
  - Proper use of clothing.
  - Proper eating and drinking habits.
  - Recognition of signs and symptoms of impending hypothermia or excessive cooling of the body, even when shivering does not occur.
  - Safe work practices.

Table 1

Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature*

Estimated Wind Speed (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 <1 hour with dry skin. Maximum danger of false sense of security.				**INCREASING DANGER** Danger from freezing of exposed flesh within 1 minute.			**GREAT DANGER** Flesh may freeze within 30 seconds.				
Trenchfoot and immersion foot may occur at any point on this chart.												

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Revised 11/1999

Table 2

Cold Work/Warmup Schedule for 4-Hour Shifts,

EQUIVALENT CHILL TEMPERATURE	MAXIMUM WORK PERIOD	NO. OF BREAKS
≥-24°F	Normal	1
-25° to –30°F	75 minutes	2
-31° to –35°F	55 minutes	3
-36° to –40°F	40 minutes	4
-41° to –45°F	30 minutes	5
≤-46°F	Stop work	Stop work

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FLD 07 WET FEET

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GENERAL

REFERENCES

Related FLD OPS:

FLD05 – Heat Stress Prevention and Monitoring
FLD06 – Cold Stress

PROCEDURE

Under both hot and cold stress conditions, feet that become wet and are allowed to remain wet can lead to serious problems. Trench foot, paddy foot, and immersion foot are terms associated with foot ailments resulting from feet being wet for long periods of time. All have similar symptoms and effects. Initial symptoms include edema (swelling), tingling, itching, and severe pain. These may be followed by more severe symptoms including blistering, death of skin tissue, and ulceration.

Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for wet feet must be considered as a physical hazard. Risk assessment can be accomplished in part in the development stages of a project by listing in the Health and Safety Plan (HASP), the most likely task where wet feet may occur. These tasks could include extended work in chemical protective clothing and wading during biological assessments. The SHSC must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or the risk is too great.

Prevention and Protection Program

Prevention methods are required when work is performed in wet conditions or when conditions result in sweating, causing the feet to become and remain wet. Proper hygiene is critical. Workers must dry their feet and change socks regularly to avoid conditions associated with wet feet. Use of foot talc or powder can additionally assist in prevention of this type of condition.

FLD 10 MANUAL LIFTING AND HANDLING OF HEAVY OBJECTS

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GENERAL

PROCEDURE

Improper lifting can result in cuts, pinches, crushing, and serious injury to back, abdomen, arm and leg muscles, and joints. Even relatively light objects, lifted improperly, can contribute to injury.

Cuts, Pinching, and Crushing

Splinters, slivers, and sharp edges on objects to be lifted can result in cuts. Heavy objects can pinch or crush fingers, toes, arms, and legs between the object and nearby objects (e.g., walls, tables, counters, or railings).

Muscle and Joint Injuries

Muscle and joint injuries occur when objects to be lifted are too heavy or awkward, are lifted improperly, or in areas where access is restricted.

Lifting tasks which are awkward and repetitive, even if involving only light objects, can lead to nerve and joint damage.

Recognition and Hazard Assessment

The need for manual lifting must be identified as a physical hazard when project tasks specifically require manual handling or use of heavy equipment, and the following safe lifting techniques must be instituted:

- Plan any lifting task, noting:
  - **Contact hazards**. Check each object before lifting for presence of splinters, slivers, sharp edges or parts, cracks and loose joints, signs of biological hazards, and chemical or radioactive material contamination.
  - **Weight of object**. Unless involved in weight training, recommended safe lifting weights for an average man or woman are 50 and 35 pounds, respectively.
  - **Size and shape of object**. Large and oddly shaped objects are more difficult to lift, even within safe weight limits, due to imbalanced center of gravity.
  - **Area in which lifting is to be done.** Check for pinch points such as other objects close by and ensure there is room for safe lifting.
  - **Conditions under which lifting is to be accomplished.** Check for wet or slippery surfaces. Also consider level of protection to be used. Level B or A protection may add up to 40 lbs. To be lifted, as well as restricting range of motion and adding to area restriction by increasing bulk.

- **Route to be traveled, if lifting includes carrying.** Check walking and working surfaces for slip and trip hazards, note ramps, changes in level of elevation, and ladders or stairways that need to be negotiated.

Prevention and Protection Programs

- Before lifting, identify the potential for contact hazards on objects to be lifted. Check each object before lifting, remove any noted hazards as feasible, and wear gloves (cotton, at a minimum, or leather, kevlar, or chemical resistant material, depending on the nature of the hazard).

- Avoid contact with, or cover cracks or loose joints to reduce hazards of pinching.

- Workers must know their lifting limitations, plan before lifting, keep themselves in good physical condition, and get help if uncertain that they can lift safely. Managers must plan and allow for safe lifting.

- When lifting an object from the floor:

  - Determine that the object is within the safe weight limit.

  - Check for contact hazards.

  - Walk the intended route of travel to identify and remove slip and fall hazards.

  - Identify changes in elevation, steps, ramps, stairs and ladders that must be negotiated.

- To lift square or rectangular objects:

  - Avoid reaching as you lift.

  - Set feet firmly, placing one foot alongside the load and the other slightly behind the load.

  - Keep objects close to the body.

  - Squat in front of the load.

  - Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.

  - Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight and tuck in the chin.

  - Straighten the legs, keeping the spine straight, pull the object into the body and stand up slowly and evenly without jerking or twisting.

  - If turning or change of direction is required, turn with feet without twisting the torso and step in the direction of travel

- To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object and the surface on which the object is set.

Workers must be trained and have the opportunity to use the above steps with lighter objects before performing heavy lifting. **For odd-shaped objects, the only modification needed should be hand-hold position**. When two or more persons are lifting, have a plan and a set of signals so lifting occurs simultaneously.

Do not carry objects in a manner which obstructs vision in the line of travel.
Carry objects so one hand is free to hold the handrail on stairs and that there is an unobstructed view of footing. Carry objects in a manner to permit use of both hands while climbing a ladder.

Manual Handling of Heavy Objects

Hazard

Manual maneuvering or handling of heavy objects without actually lifting is often required for hazardous materials and on Resource Conservation and Recovery Act (RCRA) facilities and construction sites. Manual handling of heavy objects, even when not actually lifting, can pose the same hazards as lifting including cuts, pinches, bruises, crushing, muscle and joint strain, and contact with hazardous materials and biological hazards.

Recognition and Risk Assessment

The need for manual handling of heavy objects must be addressed in the planning stages of a project Health and Safety Plan (HASP). Drums and other containers which must be maneuvered for access to information or sampling locations, that are inaccessible to mechanical handling equipment, require manual handling and special precautions. When handling of heavy objects does not actually involve lifting, workers can handle heavier objects, even those weighing several hundred pounds, safely if proper techniques are used. In many instances, the procedures involve balancing and taking advantage of the shape of the object.

Prevention and Protection Programs

Prior to performing manual handling, it must be determined that it can be done safely and that mechanical assistance is infeasible.

Mechanical equipment or assistance such as dollies, carts, come-alongs or rollers are to be used whenever possible. Mechanical assistance must be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists. Objects to be moved must be secured to prevent falling and properly balanced to prevent tipping.

The minimum protection for manual handling is heavy cotton or leather gloves, safety boots, and coveralls. Metatarsal guards, chemical protective clothing, and metal mesh or kevlar gloves must be used as risk increases of heavy items falling, hazardous materials contact and sharp edges, splinters or slivers.

Workers must be aware of and work within their weight-handling capabilities.

Objects to be manually handled must be checked for contact hazards prior to beginning movement, and to ensure handling will not trap hands, arms, legs, or feet between the object and other objects, walls, or railings.

Properly trained personnel may roll heavy objects with a round base such as 55 gallon drums or compressed gas cylinders, if rolling will not damage the structural integrity. Rolling must be controlled by chutes, tag-lines, or other means of limiting acceleration. Use of the legs for pushing and tag-line control of rolled objects must be stressed.

Only properly trained personnel may move cylindrical objects which must remain upright by hand. Cylindrical objects, such as drums that must remain upright, are handled manually by slightly tilting the object, using the legs for control, and balancing the object on the bottom edge. The handler then walks beside the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus maintaining balance and a steady controlled forward motion.

Prior to moving cylindrical objects in this way, the route of travel must be walked to identify any changes of elevation, pot holes, or other obstructions that could cause the object to snag, tip, or get out of control.

Flat, square, or rectangular objects are most easily handled using make-shift rollers or skids to break the friction with the resting surface and pushing, using the legs.

FLD 12 HOUSEKEEPING

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GENERAL

Hazards associated with poor housekeeping include slips, trips, falls, punctures, cuts, and fires.

REFERENCES

Related FLD OPS:

FLD29 – Material Handling
FLD33 – Demolition
FLD39 – Illumination

PROCEDURE

Recognition and Risk Assessment

Good housekeeping is an important element of accident prevention. Good housekeeping should be planned at the beginning of the job and carefully supervised and monitored through to the final clean-up.

Housekeeping requirements must be addressed in the planning stages of a project and safety plan. Risk assessment can be accomplished in the development stages of a project by listing in the site-specific Health and Safety Plan (HASP), good housekeeping requirements and the hazards associated with poor housekeeping (e.g., slips, trips and falls). The SHSC must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or the risk is too great.

Prevention and Protection Programs

Poor housekeeping can be prevented by following the three steps described below:

1. Plan ahead. A materials storage area which has been planned is more orderly than one which has developed haphazardly.

2. Assign responsibilities. If the size of the job and work force merit, a person should be assigned specific responsibility for clean up. Ideally, each individual should pick up his or her work area and help keep the site neat.

3. Implement the program. Housekeeping must be part of the daily routine, with clean-up being a continuous procedure.

Accidents caused by poor housekeeping can be prevented by adherence to the following rules.

Lunch areas should be kept clear of empty bottles, containers, and papers. Trash disposal cans should be provided. An effective means of preventing litter is the provision of suitable receptacles for hazardous waste, as well as nonhazardous waste.

Accumulation of flammable and combustible liquids on floors, walls, and other areas, is prohibited. All spills of flammable and combustible liquids must be cleaned up immediately. Combustible waste such as soiled rags and paper is to be stored in a safe place (such as a covered metal container) and disposed of regularly.

WESTON project managers and WESTON subcontractors should provide sufficient personnel and equipment to ensure compliance with all housekeeping requirements.

Work will not be allowed in areas that do not comply with the requirements of this section.

The SHSC and WESTON subcontractors will inspect the work area daily for adequate housekeeping and record unsatisfactory findings on the daily inspection report.

If applicable, the decontamination line must be keep neat and free of debris.

Adequate lighting should be provided in or around all work areas, passageways, stairs, ladders, and other areas used by personnel.

All stairways, passageways, gangways, and accessways shall be kept free of materials, supplies, and obstructions at all times.

Loose or light material should not be stored or left on roofs or floors that are not enclosed, unless it is safely secured.

Tools, materials, extension cords, hoses, or debris are to be used, disposed of, and stored so as not to cause a tripping or other hazard.

Tools, materials, and equipment subject to displacement or falling should be adequately secured.

Empty bags that contained lime, cement, and other dust-producing materials should be removed periodically, as specified by the designated authority.

Protruding nails in scrap boards, planks, and timbers should be removed, hammered in, or bent over flush with the wood, unless placed in containers or trucks for removal.

Walkways, runways, and sidewalks should be kept clear of excavated material or other obstructions and no sidewalls should be undermined unless shored to carry a minimum live load of 125 pounds per square foot.

Containers should be provided for storing or carrying rivets, bolts, and drift pins, and secured against accidental displacement when aloft.

When rivet heads are knocked off or backed out, they should be prevented from falling.

Form and scrap lumber and debris should be cleared from work areas, passageways, and stairs in and around building storage yards and other structures.

All storage and construction sites should be kept free of the accumulation of combustible materials.

All materials should be maintained in neat stockpiles for ease of access. Aisles and walkways should be kept clear of loose materials and tools.

Areas prone to weeds and grass should be kept mowed. A standard procedure should be established for cleanup of such areas, as specified by the SHSC.

Rubbish, brush, long grass, or other combustible material must be kept from areas where flammable and combustible liquids are stored, handled, or processed.

FLD 22 HEAVY EQUIPMENT OPERATION

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GENERAL

REFERENCES

Related FLD OPS:

FLD23 – Cranes/Lifting Equipment
FLD24 – Aerial Lifts/Manlifts
FLD34 – Utilities
FLD35 – Electrical Safety

PROCEDURE

Machinery and Mechanized Equipment Safety

Before any machinery or mechanized equipment is placed in use, it will be inspected and tested by a competent mechanic and certified to be in safe operating condition.

The employer will designate a competent person to be responsible for the inspection of all machinery and equipment daily and during use to make sure it is in safe operating condition. Tests will be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

Preventative maintenance procedures recommended by the manufacturer will be followed.

Any machinery or equipment found to be unsafe will be deadlined and its use prohibited until unsafe conditions have been corrected.

Inspections or determinations of road conditions and structures will be made in advance to ensure that clearances and load capacities are safe for the passing or placement of any machinery or equipment.

Machinery and mechanized equipment will be operated only by designated personnel. Equipment deficiencies observed at any time that affect safe operation will be corrected before continuing operation.

Seats or equal protection will be provided for each person required to ride on equipment.

Getting off or on any equipment while it is in motion is prohibited.

Machinery or equipment requiring an operator will not be permitted to run unattended.

Machinery or equipment will not be operated in a manner that will endanger persons or property, nor will the safe operating speeds or loads be exceeded.

All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. The only exemption is equipment designed to be serviced while running.

All repairs on machinery or equipment will be made at a location that will provide protection from traffic for repair persons.

Heavy machinery and equipment, or parts thereof, that are suspended or held apart by slings, hoists, or jacks also will be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

Stationary machinery and equipment will be placed on a firm foundation and secured before being operated.

All points requiring lubrication during operation will have fittings so located or guarded to be accessible without hazardous exposure.

When necessary, all mobile equipment and the operating area will be adequately illuminated while work is in progress.

Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shutoff that will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.

All towing devices used on any combinations of equipment will be securely mounted and structurally adequate for the weight drawn.

Persons will not be permitted to get between a piece of towing equipment and the item being towed until the towing equipment has come to a complete stop.

All equipment with windshields will be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields will be equipped with operable defogging or defrosting devices.

All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, will have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

Whenever the equipment is parked, the parking brake will be set. Equipment parked on inclines will have the wheels chocked or track mechanism blocked and the parking brake set.

Equipment such as lift trucks and stackers will have the rated capacity posted on the vehicle so as to be clearly visible to the operator. When auxiliary removable counterweights are provided by the manufacturer, corresponding alternate rated capacities also will be clearly shown on the vehicle. The ratings will not be exceeded.

Steering or spinner knobs will not be attached to the steering wheel unless the steering mechanism prevents road reactions from causing the steering handwheel to spin. When permitted, the steering knob will be mounted within the periphery of the wheel.

All industrial trucks in use will meet the requirements of design, construction, stability, inspection, testing, maintenance, and operation, defined in American National Standards Institute (ANSI) B56.1, Safety Standards for Powered Industrial Trucks.

The installation of live booms on material and personnel hoists is prohibited.

The controls of loaders, excavators, or similar equipment with folding booms or lift arms will not be operated from a ground position unless so designed.

Personnel will not work or pass under the buckets or booms of loaders in operation.
Cranes and any other equipment used for lifting must be inspected as required and records of inspection must be maintained.

Drill Rigs

WESTON has adopted the Drilling Safety Guide prepared by the Diamond Core Drilling Manufacturers Association and the National Drilling Contractors Association, as published by the National Drilling Federation, as the basic safety programs for all activities involving drill rigs or similar apparatus for the purpose of well installation or soil borings.

FLD 24 AERIAL LIFTS/MANLIFTS

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GENERAL

REFERENCES

Related FLD OPS:

FLD22 – Heavy Equipment Operation – General
FLD23 – Cranes/Lifting Equipment

PROCEDURE

Aerial lifts, including extensible boom platforms, aerial ladders, articulating boom platforms, vertical towers or combinations thereof, must be used in conformance with OSHA 29 CFR 1926.556, ANSI Standard A92.2, and manufacturer specifications and instructions.

- Electrical systems must be tested according to section 5 of ANSI Standard A92.2.
- Critical hydraulic lines (lines whose failure could result in free fall) must have bursting capacities four times the normal use pressure. Non-critical lines must have 2:1 bursting factors.
- Aerial lifts must be equipped with backup safety devices to prevent free descent if power supply systems or primary suspension systems fail.
- Secondary controls that can override the platform controls and emergency descent systems must also be provided in case of failure of primary systems.
- Mechanical power transmission apparatus must be appropriately guarded and guards kept in place.

Aerial lifts may not be field-modified unless certified in writing by the manufacturer or a recognized testing laboratory to be in conformance with ANSI Standard A92.2 and 29 CFR 1926.556 and to be at least as safe as before the modification.

Aerial lifts must be maintained in safe operating condition at all times. Daily recorded inspections must be made to ensure welds are not cracked, lifting cables or chains are sound, hydraulic lines are tight and not leaking, control lines and cables are sound, electrical connections are tight, and tires are sound

Required daily testing for safe operation of lift controls must be recorded.

Aerial lifts must be operated by trained persons who are completely familiar with safety and operating instructions prior to use.

- A manual of inspection and operation must be kept with the lift or be immediately available and must contain instructions for use as well as clearly indicating capacity, height limits, restrictions, warnings, and cautions.
- A statement of insulation must be prominently displayed on the unit.

- Posted on the machine must be the name and address of manufacturer, listing of acceptable alterations or alternative operating procedures and a notice to operators to read and thoroughly understand operating instructions before use.

Prior to moving over a highway or traveling where overhead utility lines or obstructions may be present, ladders, platforms or towers must be locked in the down position.

- When moving with the boom up, an inspection must be made of the entire route of the move to ensure there are no obstructions, overhead utilities, underpasses, or ground/terrain conditions that would prohibit a safe move.

- The operator/driver must have unobstructed view of the path of travel and must maintain a safe speed.

- A recorded inspection must be made to ensure proper cradling of ladders, booms, platforms or towers, and stowage of outriggers.

FLD 32 FIRE EXTINGUISHERS REQUIRED AND REQUIREMENTS

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GENERAL

REFERENCES

Related FLD OPS:

FLD09 – Hot Work (Permits)
FLD21 – Explosives
FLD22 – Heavy Equipment Operation
FLD30 – Hazardous Materials Use and Storage
FLD31 – Fire Prevention/Protection/Response Plans
FLD36 – Welding/Cutting/Burning

PROCEDURE

Fire extinguishers appropriate in size and classification shall be present, readily accessible, and ready for use in all areas where there is potential for fires.

Fire extinguishers must be used in conjunction with an emergency response or contingency plan.
Health and Safety Plans must identify number, type, and location of all fire extinguishers related to a specific project.

FLD 34 UTILITIES

PURPOSE

This program provides requirements for identification, location, and avoidance of underground utilities, appurtenances, and structures during intrusive activities. The program also addresses actions to be taken in response to encountering or contacting underground utilities. These requirements are applicable to all Weston Solutions, Inc. (WESTON) operations. The procedures address the requirements and recommendations for identifying and locating, working around, and encountering or contacting underground utilities.

DEFINITIONS

Aggressive Methods

The use of mechanized equipment such as excavators, backhoes, drill rigs, directional drilling, road saws, etc. Non-Aggressive methods involve the use of manual methods such as hand digging with shovels and air/hydro/vacuum methods.

Buffer Zone

As defined in this procedure, the area around a utility where only non-aggressive excavation methods may be utilized, unless specific conditions are met.

The definition cited above, and the excavation requirements and restrictions associated with it, will vary depending on the particular state regulations. WESTON requires the imposition of a four-foot Buffer Zone on all sides of the utility as measured from the outside edges of the utility, both horizontally and vertically. Since most jurisdictions recognize Buffer Zones which vary somewhere in the range of 18 to 36 inches, this distance must be verified by consulting the applicable state regulations before excavating so that adjustments to surface markings can be made to achieve the WESTON-required four-foot buffer zone.

Referred to as the "Tolerance Zone", "Safety Zone", or "Approximate Location of Underground Utilities" in some jurisdictions.

Competent Person

A Competent Person has the ability to recognize hazards associated with underground utilities and the authority to stop or direct operations to ensure the safety of personnel and conformance with this procedure. The Competent Person has an understanding of this procedure, and the "One-Call" system requirements for the jurisdiction where excavation is occurring. The Competent Person must be capable of notifying One-Call agencies and maintaining and tracking One-Call Locate Numbers. Additionally, they must have knowledge of methods and work practices for utility identification, avoidance, and protection.

The designation of a Competent Person will be made by the Site or Project Manager with the concurrence of the Division EHS Manager.

De-Energize

As applicable to a utility, to physically eliminate and/or prevent the presence, transmission, flow, or release of energy or materials which may cause harm to personnel or property.

Excavation (Intrusive Activity)

An operation for the purpose of movement or removal of earth, rock, or the materials in the ground, including but not limited to; digging, blasting, augering, test boring, drilling, pile driving, directional drilling, grading, plowing-in, hammering, pulling-in, jacking-in, trenching, tunneling, structural demolition, milling, scraping, tree and root removal (grubbing), fence or sign post installation. WESTON requires that the designated One-Call Agency for the applicable jurisdiction be contacted any time an intrusive activity is planned.

Jurisdiction

The authority having legal jurisdiction relative to regulations and requirements for notification of excavation activities and associated identification and marking. In the United States, the states have jurisdiction, and most consider the regulations applicable when excavation is to be performed in any location, including any public or private way, any company right-of-way or easement, or any public or privately owned land or way. Note: One caveat to remember – Jurisdiction may flow to the "owner" on private or government-owned property because the State One-Call Agencies may not clear utilities on such facilities.

Locate

To indicate the existence of a utility by establishing a mark through the use of flags, pins, stakes, paint, or some other customary manner, that approximately determines the location of a line or facility.

Locate Request

A communication between an entity performing intrusive activities and a utility marking Agency (One-Call, etc).

Observer

The person assigned to visually monitor and, as needed, signal the operator during mechanized intrusive activity when the activity is occurring within four feet of the outside edge of the buffer zone. This person remains in close communication with the equipment operator(s) and will stop the activity if needed.

One-Call Agency

An entity that administers a system through which a person can notify owners/operators of underground lines or utilities of the intent to perform intrusive activities in proposed public areas.

Positive Response

Communication with the entity performing intrusive activities, prior to the activity, to ensure that all contacted (typically via the One-Call Agency) owner/operators have located and marked the underground utilities.

Potholing

The practice of exposing an underground facility by safe, non-aggressive excavation methods in order to ascertain the precise horizontal and vertical position and orientation of underground lines or utilities.

Underground Utility

An underground or submerged conductor, pipe, or structure used in providing electric or communications service (including but not limited to, traffic control loops and similar underground or submerged devices), or an underground or submerged pipe used in carrying, providing, or gathering gas, oil or oil product, sewage, storm drainage, water or other liquid service (including, but not limited to, irrigation systems), and appurtenances thereto. As used in this procedure, utility includes all underground appurtenances and structures.

The following are examples of the types of underground utilities that may be present in a given location:

- Natural gas pipelines
- High voltage electric cables
- Water pipelines
- Fiber optic telecommunications lines
- Telephone cable lines
- Steam pipelines
- Gasoline, oil, or other fuels
- Sewer pipelines
- Vents for sewer and gasoline/diesel fueling systems
- Underground Storage Tanks (USTs)
- Abandoned underground structures containing hazardous materials, hazardous wastes, and radioactive materials

Note: Electrical and pressurized mechanical underground utilities that are not energized shall be considered as applicable to the requirements of this procedure until they are disconnected, de-energized removed and/or protected by a lockout/tagout system approved by WESTON.

Underground Utility Owner

Any person, utility, municipality, authority, political subdivision or other person or entity who owns, operates, or controls the operation of an underground line/facility.

White Lining

The practice whereby the entity, which intends to perform intrusive activities, pre-marks the site with an outline of the area where intrusive activities will occur. This involves the use of white paint, flags, stakes, or a combination thereof to mark the extent of where work is to be performed. The marking may vary depending on what intrusive activities are to be conducted. For example, for general excavation, an areal outline of the excavation shall be marked, while for drilling, the individual boreholes shall be marked. Studies have shown that pre-marking is a practice that does prevent utility contact incidents. Check State or local regulatory requirements to ensure compliance.

RESPONSIBILITIES

Competent Person

The Competent Person shall be responsible for:

- Obtaining a copy of, and understanding the applicable regulations for the state of jurisdiction where the excavation activities are to be performed.
- Contacting the appropriate One-Call Agency or private locating service, as applicable.
- Recording One-Call locate numbers.
- If necessary, renewing One-Call locate numbers before expiration.
- Ensuring that white-lining of the area to be excavated is performed; if another equal or better protective measure is necessary because of the nature of the work, state/local regulation or client requirements, the Health and Safety Plan should be amended to reflect the change.
- Ensuring that a "positive response" has been received from every utility owner/operator identified by the One-Call Agency and that they have located their underground utilities and have appropriately marked any potential conflicts with the areas of planned intrusive activities prior to the start of intrusive work.
- Completion of the Underground Utilities Locating and Marking Checklist (Attachment A) and the Underground Utilities Management Checklist (Attachment B).
- Reviewing applicable Activity Hazard Analyses (AHAs) with all project members before work begins.
- Conducting training on communication protocols to be used by the excavation observer and equipment operator.
- Ensuring Implementation of appropriate work practices during intrusive activities (including maintaining the prescribed buffer zone for use of aggressive methods).
- Conducting daily or more frequent (due to changes in conditions) inspections of the excavation area to make sure that all markings are intact.

- Maintaining required records (see Attachments A & B).
- Providing the Site Health and Safety Coordinator (SHSC) with all required documentation on a daily basis.

Observer

Whenever intrusive operations with mechanized equipment are being conducted within four feet of the outside edge of the buffer zone, horizontally and vertically, an observer must be assigned to monitor the activities. The observer is responsible for:

- Maintaining a safe vantage point relative to digging machinery, excavation edge and proximity to the hazard posed by the utility.
- Observing the operation to ensure that the operator stops operations if utilities are observed.
- Reviewing hand signals and other forms of communication with the operator.
- Properly signaling the operator.
- Stopping the operation immediately if the observer's attention must be diverted even momentarily.
- Stopping the operation immediately if a hand signal or other directive is not followed. Operations will not resume until the observer and operator mutually agree that the reason(s) for not complying with the directive(s) are/is identified and fully corrected.
- Maintaining required records, such as logbook entries, or other, as requested by line management.

Line Management

The Project Manager (PM) or Site Manager (SM) {e.g., the on-site manager} shall be responsible for:

- Establishing the site culture with the assistance of the Site Health and Safety Coordinator that ensures compliance with this procedure.
- Providing the necessary resources for compliance with this procedure.
- Designating Competent Personnel in consultation with the Division EHS Manager prior to the start of work.

Environmental, Health and Safety Personnel

The Site Health and Safety Coordinator (SHSC) shall be responsible for:

- Providing oversight on the implementation of the requirements contained in this procedure.
- Consulting with the PM, SM and Competent Person on underground utility issues.

PROCEDURE

The following sections provide the requirements and recommendations of this procedure, which are intended to prevent injury to personnel, damage to infrastructure, and associated indirect effects associated with encountering or contacting underground utilities during the execution of intrusive work. Underground utilities present multiple potential hazards that must be recognized before and during work which occurs near them, therefore, this procedure is divided into sections addressing underground utility identification and location, working around or near underground utilities, and actions to be taken in the event that underground utilities are encountered or contacted. Hazards that may be presented by underground utilities include explosion and fire, electrocution, toxic exposures, pathogens, and drowning.

Identifying and Locating Underground Utilities

The possibility of the existence of underground utilities ***(note: also consider the impact of any subsurface mining activities)*** must be evaluated as early as possible in the planning phase for any project, which involves intrusive activities. The following sections describe various methods for identifying and locating utilities on a site. Plans should be verified during the readiness review. The *Underground Utilities Locating and Marking Checklist* (Attachment A) and the *Underground Utilities Management Checklist* (Attachment B) must be completed before any activities meeting the definition of excavation are conducted. Attachment A is intended to be used as a guide during the process of locating and marking utilities in the area to be excavated. Attachment B is intended to be used as a guide in the overall process of underground utilities management during the course of the project. **Note:** Attachments A and B or their equivalents must be used to document compliance with this operating procedure and will be subject to audit.

All underground utilities on a site involving excavation must be located and identified before intrusive activities commence, by at least two of the following:

- ***The Utility Owner***
- ***A Private or Public Utility Locating Service***
- ***Review of the most current utility drawing, maps or other available records by an approved WESTON Competent Person***
- ***Use of utility locating technology by a WESTON Competent Person or Subcontractor***

Pre-Planning and the Site HASP

The Site-Specific Health and Safety Plan (HASP) developed for the project must:

- Identify the location and types of underground utilities that are believed to be present on the site.
- Reference this procedure (FLD 34), and describe how it will be implemented on the project.
- Contain an Activity Hazard Analysis in which the hazards associated with underground utilities are identified, as well as the measures used to control them.
- Contain, as an appendix, a copy of the applicable regulations from the state of jurisdiction where excavation activities are to be performed. These can usually be obtained via the Internet.

- Contain clear and concise procedures to be followed in the event that contact with underground utilities occurs.

- Address underground utilities and potential associated scenarios in the emergency response section of the HASP.

"One-Call" Locating and Marking Services

Every state has utility marking service programs having various names such as "One-Call", "Dig-Safe", "Call-Before-You-Dig", "Dig-Safely", and many others. These services will identify the types and locations of any utility that may exist in an area to be excavated, as long as the property is in the public domain.

- The appropriate One-Call service for the jurisdiction where the project is located must be contacted prior to beginning excavation work. The One-Call Agency should be given as detailed a description of the property as possible; address, cross street, utility pole numbers, physical description, etc.

- Notification to the One-Call service shall allow sufficient lead-time for the Agency to mark the utilities before excavation begins. The lead times vary, but range from two to ten days, depending on the state of jurisdiction.

- A complete listing of One-Call agencies and telephone numbers for all states is available in the *"Call-Before-You-Dig Call Center Directory"*, which can be accessed on the Internet at the WebPage (http://underspace.com/index.htm) sponsored by *"Underground Focus"* magazine.

- Once notified, the One-Call Agency will provide the contractor with a unique "locate number" or "reference number". This reference number must be kept in the project files by the Competent Person or designee. Additionally, the reference numbers have expiration dates, which may vary depending on the particular One-Call Agency. The valid period of the locate number and required renew notification date shall be requested from the One-Call Agency.

- On a project with multiple contractors, each contractor must request a separate locate number. Under no circumstances will any other contractor or entity be allowed to "work under our locate number". Subcontractors to WESTON may excavate under the locate number secured by WESTON, provided that they are excavating within the area which was previously white-lined by WESTON and subsequently marked. **However, the One-Call Agency must be contacted and notified of this arrangement so that the subcontractor can be recorded as working under the existing locate number.** If a WESTON subcontractor will be excavating in an area not white-lined by WESTON, then the WESTON subcontractor must request a new locate. **Note: State and local requirements must be checked for local application of this procedure.**

- The area where work is to be performed shall be white-lined by WESTON personnel before the locating service goes to the site.

- It is good practice to arrange a pre-excavation meeting at the project site with the personnel performing the utility location and marking. This meeting will facilitate communications, coordinate the marking with actual excavation, and assure identification of high-priority utilities.

- The One-Call Agency should provide the identities of the utility owners that will be notified of the locate request. This information shall be recorded on the Underground Utility Locating and Marking Checklist (Appendix A) and maintained in the project files. The contact person and phone number for each utility owner shall also be recorded.

- The utility owners should provide a "positive response" relative to the locate request, which can consist of two types of action by the utility owner. The facility owner or operator is required to 1) mark it's underground utilities with stakes, paint, or flags, or 2) notify the excavator that the utility owner/operator has no underground utilities in the area of the excavation.

- The positive responses shall be recorded on the Underground Utility Locating and Marking Checklist (Appendix A) and crosschecked with the list of utility owners that the One-Call Agency stated that they would notify. If it is discovered that a utility owner has not provided a positive response, then the One-Call Agency must be notified.

- Excavation shall not be conducted until positive responses have been received from all utility owners identified by the One-Call Agency as having underground utilities on the property.

- Before beginning excavation, the excavator must verify that the location marked was correct, and the distinct, color-coded markings of all utility owners are present.

- Examine the site to check for any visible signs of underground utilities that have not been located and marked such as pedestals, risers, meters, warning signs, manholes, pull boxes, valve boxes, patched asphalt or concrete pavement, areas of subsidence, fresh sod or grass, lack of grass or vegetation, and new trench lines.

- The markings placed by the utility owners should be documented by WESTON using a still, digital, or video camera, whenever practical and reasonable.. The photo-documentation shall be maintained with the project files.

- The markings placed by the utility owners or marking services shall follow the American Public Works Association Uniform Color Code as described in ANSI Standard Z 535.1. This code follows:

American Public Works Association Uniform Color Code

Red		Electric Power Lines, Cables, Conduit
Orange		Communications, Telephone, Cable TV
Yellow		Gas, Oil, Steam, Petroleum or Gaseous Materials
Green		Sewers and Drains
Blue		Potable Water Systems
Purple		Reclaimed Water, Irrigation, Slurry Lines
Pink		Temporary Survey Markings
White		Proposed Excavation

Note: Unless otherwise specified in the utility clearance, such clearance will not be considered valid after 30 days from the date it was issued.

Private Utility Locating and Marking Services

- **One-Call agencies arrange for the identification and marking of underground utilities only on public property, up to the point of contact with private property.** In the event that activities are to be conducted on non-public properties, the presence, location, depth, and orientation of all underground utilities shall be ascertained through records review, including any site plot plans, utility layout plans, and as-built drawings available from the property owner, as well as through interviews with knowledgeable personnel associated with the property. Additionally, the information gathered from these sources shall be verified by physical detection methods (non-aggressive), performance of a geophysical survey, or by procuring the services of a private utility locating and marking service. If any detection methods are to be self-performed, the requirements within this FLD must be followed. **A list of vendors providing this service can be found in the *"Network of Underground Damage Prevention Professionals"* which can be accessed on the Internet at the *"Underspace"* WebPage (http://underspace.com/index.htm).**

Self-Performance of Utility Locating and Marking

The techniques and instruments used to locate and characterize underground utilities can be extremely complicated and difficult to use effectively. Additionally, interpretation of the data generated by this instrumentation can be difficult. The utility marking services, as previously described are staffed by well-trained, experienced professionals who perform locating activities on a regular basis. For these reasons, it is most desirable that these professional services are used for utility location and marking on projects.

- In some instances, such as long-term projects where excavation is a primary task, and the presence of underground utilities is extensive, it may be prudent to self-perform locating and marking activities.

- If locating and marking is to be self-performed, all personnel using instrumentation will be trained on the use of the equipment that will be used, and the interpretation of the data.

- There are variety of locating methods which may be utilized for self-performance of utility locating as categorized below:

  - Magnetic field-based locators or path tracers
  - Buried electronic marker systems (EMS)
  - Ground penetration radar-based buried –structure detectors
  - Acoustics-based plastic pipe locators
  - Active probes, beacons, or sondes for non-metallic pipes
  - Magnetic polyethylene pipe

- Before self-performing any underground utility locating on a project, approval must be obtained from the appropriate WESTON Division EHS Manager or the Director, Corporate EHS and QA.

Working Near or Around Underground Utilities

After the site has been properly evaluated for the presence of underground utilities, intrusive activities may begin. Since there is no perfect way of eliminating the hazards presented by underground utilities, an effort must be made to perform the tasks following the direction and guidance as described by the following best practices that should be implemented during the execution of the project.

Work Site Review

Before beginning intrusive activities, a meeting shall be held between all members of the project team. This shall consist of a review of the marked utility locations with the equipment operators, observers, laborers, etc.

Preservation of Marks

During excavation, efforts must be made to preserve the markings placed by the utility owners until they are no longer required. If any markings are obliterated, the One-Call Agency must be contacted for re-marking. No intrusive activities are to take place if markings are not visible.

Excavation Observer

Whenever intrusive operations are being conducted within four feet of the edge of the buffer zone, an observer must be assigned to monitor the activities. The observer will be designated each day, and a review of hand signals and other forms of communication between the observer and operator will be conducted. The directives of the observer will be followed precisely and immediately by those operating equipment.

Excavation Within The Buffer Zone

Performing intrusive activities within the buffer zone requires careful adherence to proper guidelines and procedures to minimize the risk of contact with underground utilities.

The purpose of the buffer zone is to designate and define an area where careful, prudent, and reasonable excavation practices are to be used to prevent contact with underground utilities. However, there may be occasions where it is necessary to perform aggressive excavation methods in this designated area.

The boundaries of the buffer zone will be observed at all times during intrusive activities. Aggressive excavation methods (excavators, backhoes, drill rigs) must be restricted to areas outside of the 4-foot buffer zone unless a special exemption to this requirement is obtained.

Consider whether the objective of the project can be completed without performing intrusive activities in the buffer zone at all. This will greatly reduce the risks presented by performing work in close proximity to underground utilities. If after consideration, the determination is made that intrusive activities in the buffer zone are necessary, then a formal exemption request shall be made to the Division EHS Manager according to the guidelines below.

A request to utilize aggressive excavation methods in the buffer zone may be made if:

- There is no other appropriate and reasonable alternative to using aggressive methods in the buffer zone; and
- The utility has been de-energized (and purged if necessary), verified as de-energized, and locked-out;

  Or

  The depth and orientation of the utility has been adequately and visually determined through the use of non-aggressive methods such as air/hydro/vacuum excavation, potholing, probing, hand-digging, or a combination thereof; and
- For utilities containing electrical energy, the depth of the existing water table is below the location of the utility; and
- Request for the exemption has been submitted to the appropriate Division EHS Manager and approved.

The following conditions will apply to this request:

- Aggressive methods may be used in the buffer zone only to the extent allowed by the applicable state or other jurisdictional regulations.
- Appropriate physical protection measures for exposed utilities shall be implemented to eliminate the potential for equipment contact with utilities.
- The extent of the project excavation area to be covered by the exemption request must be specified in the request for exemption.
- When evaluating the use of aggressive excavation methods in the buffer zone, the Division EHS Manager will consider the type of utility involved and the associated risk potential. Based on this evaluation, the Division EHS Manager may impose further conditions and requirements. Even if the above exemption conditions are met, the Division EHS Manager has authority to deny the request, the reasons for which will be provided at the time of denial.

Unless exempted according to the above provisions of this procedure, only non-aggressive methods may be used within the buffer zone. Non-aggressive, or non-mechanized equipment is used in order to prevent mechanical contact with underground utilities, which could result in damage to the utility and create the potential for personal injury and property damage. Following are examples of non-aggressive excavation methods:

- Hand-digging
  - Non-conductive hand tools must be used when digging within the buffer zone surrounding underground electrical utilities.
  - If conductive hand tools must be used near electrical lines, then the SHSC shall be consulted to determine additional requirements relative to safe electrical practices, procedures, and equipment.

- Hydro-excavation (water pressure).
- Air excavation (air pressure).
- Vacuum extraction (soil excavation/removal).
- Air excavation/vacuum extraction combination.
- Aggressive methods may be used for the removal of pavement over a utility, if allowed by the state regulations.

Protection of Underground Utilities

It is very important that consideration be given to the protection of underground utilities when performing adjacent intrusive activities. This is necessary not only to prevent physical damage and associated indirect effects, but also to prevent the potential for injury to employees and the public.

- When using aggressive excavation methods within the buffer zone around exposed underground utilities, physical protection must be used as required by OSHA in 29 CFR 1926.651. Basically, this involves creation of a physical barrier between the mechanized operation and the utility. The following are some possible types of physical protective measures:
    - Heavy timbers, similar to swamp mats.
    - Sheets of plywood.
    - Blasting mats.
- Once exposed, underground utilities no longer have the support provided by surrounding soil and may need to be physically supported to prevent shifting, bending, separation, or collapse, which could result in damage to the utility, and possibly personnel. Following are suggested support methods:
    - Timber shoring underneath the utility.
    - Timbers or girders over the top of the excavation fitted with hangers that support the utility.
    - Design by a PE for complicated or large applications.
- Utilities must also be protected from objects that may fall into the excavation such as rocks and equipment. This can be accomplished by following these guidelines:
    - Cast spoils as far away from the excavation as possible. Excavated and loose materials shall be kept two feet from the edge of excavations, as required by OSHA.
    - Relocate large rocks, cobbles, and boulders away from the excavation and sloped spoils piles.
    - When vehicles and machinery are operating adjacent to excavations, warning systems such as soil berms, stop logs or barricades shall be utilized to prevent vehicles from entering the excavation or trench.

- Scaling or barricades shall be used to prevent rock and soils from falling into the excavation.

- Barriers shall be provided to prevent personnel from inadvertently falling into an excavation.

De-Energizing Utilities

Utilities can carry many types of potential energy, including electricity, flowing liquids, liquids under pressure, gasses under pressure, etc. A release, such as may happen if a utility conveyance is compromised, could result in personal injury, property damage, and other indirect effects. If the white lines of the proposed excavation area overlaps or extends into the buffer zone of a known underground utility, then if at all possible, that utility shall be de-energized to physically prevent the transmission, flow, or release of energy. Conversely, if the buffer zone of the known utility lies outside of the white-lined, proposed excavation area, then de-energization is not required.

- The owner of the utility shall be contacted to determine the feasibility and methodology of de-energizing the utility. Plenty of lead-time should be provided for this since it may take utility companies weeks to de-energize some utilities.

- Depending on the utility and the material being conveyed, isolation points which may be suitable for de-energizing include but are not limited to the following:

  - Electrical circuit breakers
  - Slide gate
  - Disconnect switches
  - Piping flanges
  - Other similar devices

- When utilities are de-energized, it must be verified by demonstration. This can be accomplished by testing equipment, switching on a machine or lighting, opening a valve, etc. For any current-carrying electrical equipment, such as cables, electrical panels, etc., successful de-energization must be certified through the use of appropriate electrical testing equipment.

- Whenever a utility is de-energized, a means of ensuring that the energy isolation device and equipment cannot be operated until the device is removed must be provided. Typically, this is achieved by utilizing a lockout device, accompanied by a written tag, that physically controls the configuration of the energy isolation point. Lockout devices include but are not limited to the following:

  - Locks
  - Chains
  - Valve covers
  - Circuit breaker hasps
  - Blind flanges
  - Slip blinds, and
  - Multiple lock hasps

- When de-energizing and locking out of utilities is practiced, the provisions of FLD 42 Lockout/Tagout shall be followed, as applicable.

- In the event that a utility is de-energized, but there is no means of adequately providing a physical locking-out of the utility, then a spotter must be posted at the point of isolation to ensure that the utility is not re-energized. The spotter must be supplied with a communication device such as a site radio.

Damage Discovery

During excavation, utility damage may be discovered which is pre-existing or otherwise not related to a known contact. Disclosure to the utility owner is very important because the possibility of utility failure or endangerment of the surrounding population increases when damage has occurred. The utility may not immediately fail as a result of damage, but the utility owner or operator must be afforded the opportunity to inspect the utility and make a damage assessment and effect repairs if necessary. The following guidance applies:

- Observe and photograph the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, or other damages to utility lines, conduits, coatings, or cathodic protection systems.
- The One-Call Agency or private location service must be contacted immediately.
- A Notification of Incident (NOI) Report should be used to document such a discovery.

Encountering or Contacting Underground Utilities

In the event that encountering or contacting an underground utility occurs, it is imperative that the appropriate actions are taken to minimize damage to the utility, prevent personal injury, and minimize indirect effects.

Encountering Underground Utilities

It is possible that underground utilities will be encountered in locations that have previously been "cleared" of having underground utilities by the locating service, or are found outside of the area, which has been marked as having underground utilities. In either case, if this occurs, the following applies:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.
- Intrusive activities must be stopped
- The One-Call Agency or private location service must be contacted immediately
- The PM, SM and SHSC must be notified
- No further intrusive activities may be conducted until:
    - The One-Call Agency/private location service and/or the subject utility owner visit the site;
    - Identification of the utility owner and the type of material/energy being conveyed by the utility has been made; and

- The orientation and depth of the subject utility has been determined and suitably marked.

- A WESTON Notification of Incident (NOI) Report and Investigation form must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.

- Any exceptions to, or deviations from these requirements must be reviewed and approved by the appropriate Division EHS Manager (e.g., abandoned lines at certain Brownfield sites that may be encountered an confirmed as abandoned/not active).

Contacting Underground Utilities

If excavation or other equipment being used for intrusive activities makes contact with an underground utility, the following guidelines apply:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.

- Intrusive activities must be stopped immediately.

- Observe the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, scratched coatings, cathodic protection compromise, material leakage, obvious electrical energy.

- Move all personnel to the evacuation meeting point as described in the HASP.

  EXCEPTION: If an electrical line has been contacted and it is your belief that equipment (such as an excavator) is electrically energized, do not approach the equipment. Order the operator to remain in the equipment until emergency personnel can de-energize the source (unless the equipment is on fire, at which time the operator should jump off of the vehicle and shuffle along the ground to a safe area). Shuffling is required because current flows outward through the soil in a ripple pattern called a power gradient, creating a pattern of high and low potential. Shuffling decreases the chance that these gradients could be bridged, causing current to flow through the body, resulting in electrocution.

- Secure the area to prevent the public from entering.

- Contact emergency responders as specified in the HASP.

- The One-Call Agency or if known, the utility owner must be contacted immediately.

- The PM, SM and SHSC must be notified.

- No further intrusive activities may be conducted until:

  - The utility owner inspects the scene and after repairs, verifies that all danger has passed.

  - The orientation and depth of the subject utility has been determined and suitably marked.

- Permission from the emergency responders to resume work has been given.

- A WESTON Notification of Incident (NOI) Report and Investigation form must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.

- State and Local regulations must be reviewed to determine if reporting to any additional agencies is required.

Training

Competent Persons shall have adequate experience and/or training to carry out the requirements of this procedure.

SOURCES OF INFORMATION

Organizations

- Common Ground Alliance
  http://www.commongroundalliance.com/wc.dll?cga~toppage

- Center for Subsurface Strategic Action (CSSA)
  http://underspace.com/cs/index.htm

- DigSafely
  http://www.digsafely.com/digsafely/default.asp

- National Utility Contractors Association (NUCA)
  http://www.nuca.com/

- National Utility Locating Contractors Association (NULCA)
  http://underspace.com/nu/index.htm

- Underground Focus Magazine
  http://underspace.com/uf/index.htm

- NUCA State Listing of One-Call centers
  http://www.nuca.com/

- Utility Safety Magazine
  http://www.utilitysafety.com/

Vendors and Commercial Sites

- RadioDetection, Inc. (Detection Instruments)
  http://www.radiodee.com/

- Heath Consultants (Detection Instruments)
  http://www.heathus.com/

- Ben Meadows Company (Detection Instruments)
  http://www.benmeadows.com/cgi-bin/SoftCart.exe/index.html?E+scstore

- So-Deep, Inc. (Complete Utilities Services)
  http://www.sodeep.com/

- Concept Engineering Group, Inc. (Air Excavation Equipment)
  http://www.air-spade.com/index.html

- Rycom Instruments, Inc. (Detection Instruments)
  http://www.rycominstruments.com/

- Schonstedt Instrument Company (Detection Instruments)
  http://www.schonstedt.com/

- Forestry Suppliers, Inc. (Fiberglass Probe – "Fiberglass Tile Probe", Part #77543, Approx. $20.00, Telephone 800-647-5368)
  http://www.forestry-suppliers.com/

REFERENCES

- Common Ground Study of One-Call Systems and Damage Prevention Best Practices, August, 1999, Sponsored by US DOT.

ATTACHMENTS

Attachment A – Underground Utilities Locating and Marking Checklist
Attachment B – Underground Utilities Management Checklist

FLD 34 UTILITIES - ATTACHMENT A
UNDERGROUND UTILITY LOCATING AND MARKING CHECKLIST
Weston Solutions, Inc.
To be Completed by PM and/or "Competent Person"
Complete Form as Location/Marking Progresses and Maintain in Site Files

PROJECT INFORMATION:	Location:
Project Name:	Task/Activity:
Weston Competent Person:	Start Date of Work:
Weston Subcontractor: ☐ No ☐ Yes:	Private Locating Service Required: ☐ Yes ☐ No
Property Owner:	If Not, Explain:
NOTIFICATION:	
Locating Service Name:	Locating Service Tel. Number:
Date Locating Service Notified:	Locate Ticket Number:
Address of Property to be Marked:	Locate Ticket Expiration Date:
Nearest Intersecting Street:	
Are There Any Utilities on the Properties That the Locating Service Will Not Contact? ☐ Yes ☐ No	
Specify:	
Enter Utility Information in Table 1 Below. In Addition to Utility Locating Services, Consult Client, Utility Owners, Drawings, Facility Personnel, Maintenance Personnel, Municipalities, etc.	

TABLE 1
ON-SITE UTILITY INFORMATION

NAME OF UTILITY COMPANY	TYPE OF UTILITY	COLOR CODE	UTILITY PRESENT ON-SITE?	EMERGENCY PHONE NUMBER	DATE MARKS COMPLETED
	Electric	RED			
	Communications, Phone, CATV	ORANGE			
	Gas, Oil, Steam, Petroleum	YELLOW			
	Sewers, Drains	GREEN			
	Potable Water	BLUE			
	Reclaimed Water, Irrigation	PURPLE			
	Temporary Survey Markings	PINK			
To be performed by excavator prior to utility mark-out.	Proposed Excavation	WHITE			

White-Lining Completed? ☐ No Explain: _____ ☐ Yes: Date: _____ By Whom? _____

LOCATING AND MARKING:

Have All Utilities Identified in Table 1 Been Marked? ☐ Yes ☐ No (If Not, Contact Locating Service for Resolution)
Problem(s) With Markings?
☐ Yes ☐ No ☐ No Marks ☐ Incorrect Location ☐ Too Wide
☐ Other: _____ ☐ Not All Utilities Marked Per Table 1 (notify marking service)
Measurements Taken: ☐ Yes ☐ No
Documentation of Marks: ☐ Photos ☐ Video ☐ Other: _____

EXCAVATION:

Utilities Accurately Marked? ☐ Yes ☐ No
If no, describe: _____
Were Unmarked or Mis-Marked Utilities Encountered? ☐ Yes ☐ No
If Yes, Specify: _____
Locating Service Notified? ☐ Yes ☐ No
Will Excavation Continue Past Locate Number Expiration? ☐ Yes ☐ No
If Yes, Locate Number Renewed? ☐ Yes ☐ No New Expiration Date: _____
Any Other Problems/Concerns? Specify: _____

Form Completed By:	Signature:	Date:

FLD 34 UTILITIES - ATTACHMENT B
UNDERGROUND UTILITIES MANAGEMENT CHECKLIST
Weston Solutions, Inc.
To be Completed by PM and/or "Competent Person"
Complete Form as Project Progresses and Maintain in Site Files.

PHASE		TASK	YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
Pre-Planning	1.	Excavation in Work Scope?				
	2.	Underground Utilities Identified?				
	3.	Competent Person Assigned?				
	4.	Has a Copy of the Applicable State Regulations Been Obtained, Read, Understood?				
	5.	EHS Plan Addresses Underground Utilities? (AHAs, Contingency Plan, State Regulations Appendix)				
Identifying, Locating and Marking	6.	Locating and Marking Checklist Initiated? (Attachment A)				
	7.	Identification and Address of Property Determined, Including Nearest Intersection?				
	8.	One-Call Agency Contacted?				
	9.	Additional Locating and Marking Required on Property? (One-Call agency marks to public property line only)				
	10.	Additional Marker/Locator Identified?				
	11.	Additional Marker/Locator Qualified?				
	12.	Weston Self-Performing Location and Marking?				
	13.	If Yes to 12 Above, Approval From Division EHS Manager?				
	14.	Area of Excavation "White-Lined" by WESTON?				
	15.	WESTON Present When Markings Completed?				
	16.	All Utilities Marked? (Refer to Attachment A, Table 1)				
	17.	All Markings Photo/Video Documented?				
	18.	Area Checked for Signs of Previous Excavation? (Subsidence, new grass, patching, etc)				
	19.	All Applicable Information Recorded on Attachment A?				
	20.	Multiple Contractors Excavating On-Site?				
	21.	Separate Locate Requests for All Contractors?				
	22.	WESTON Subcontractors Excavating in WESTON White-Lined Area(s)?				
	23.	If Yes to 22 Above, One-Call Agency Contacted to Determine if WESTON Subcontractor Can be Added to Existing Locate Ticket?				
Excavation Activities	24.	Meeting and Site Walkover Conducted with Project Personnel? (Managers, Equipment Operators, Laborers, Competent Person, Excavation Observer, etc)				
	25.	AHA and HASP Review Conducted With Personnel?				
	26.	Do Site Activities Have Potential to Obliterate Utility Markings?				
Excavation Activities – Cont'd	27.	If Yes to 26 Above, Have Provisions Been Made to Preserve Markings?				

PHASE		TASK	YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
	28.	Has an Excavation Observer Been Designated to Monitor Excavation When Occurring within 4 Feet of the Buffer Zone?				
	29.	Have Operator and Observer Reviewed Commands and Signals?				
	30.	Has WESTON-Required 4-Foot Buffer Zone Been Marked on Either Side of Markings Placed by Locator?				
Excavation Within Buffer Zone	31.	Is Excavation Within The Buffer Zone Absolutely Necessary?				
	32.	If Yes to 31 Above, Can Non-Aggressive Methods Be Used For Excavation In The Buffer Zone? If Yes, Identify Appropriate Non-Aggressive Methods.				
	33.	If No to 32 Above, Has a Buffer Zone Exemption Request Been Approved? If No, then Aggressive Methods May Not Be Used in The Buffer Zone.				
	34.	If Yes to 33 Above, Has the Utility Been De-Energized, Purged, Verified/Tested, and Locked-Out? Or, Has The Depth and Orientation of the Utility Been Adequately and Visually Determined Through The Use of Non-Aggressive Methods?				
	35.	If Yes to 34 Above, Have All of The Following Conditions Been Met? For Utilities Containing Electrical Energy, Is The Depth of The Water Table Below The Depth of The Utility? Have Regulations Been Consulted to Determine Specific State Requirements Relative to Excavating in The Buffer Zone? Have Appropriate Physical Protection Measures Been Implemented to Prevent Equipment Contact With Utilities and to Prevent Damage to Utilities? If No to Any of The Above Conditions, Then Only Non-Aggressive Excavation Methods May Conducted in The Buffer Zone, Since The Conditions of The Exemption Have Not Been Satisfied.				
Working Around Exposed Utilities	36.	If Necessary, Have Provisions Been Made to Support the Utility During Work Activities?				
	37.	Have Spoils Been Placed as far Away From the Excavation as Feasible?				
	38.	Has the Utility Been De-Energized? (If Any Portion of the 4-Foot Buffer Zone around a Utility is Inside of the White-Lined Area)				
	39.	Has the Isolation Point for the De-Energized Utility Been Physically Locked-Out?				
Working Around Exposed Utilities – Cont'd	40.	If No to 39 Above, Has a Spotter Been Assigned to Monitor Isolation Point?				
	41.	If Yes to 40 Above, Does the Spotter Have Adequate Communications? (Radio, Telephone, etc)				
	42.	Has the Isolation Point Been Tagged?				
Damage Discovery	43.	Has Pre-Existing Damage to a Utility Been Discovered During Excavation?				

PHASE		TASK	YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
	44.	If Yes to 43 Above, Has the One-Call Agency and/or Utility Owner Been Notified?				
	45.	If Yes to 43 Above, Have Photographs Been taken?				
Encountering or Contacting Underground Utilities	46.	Have Utilities Been Encountered in Locations That Have Not Been Marked?				
	47.	If Yes to 46 Above, Has the One-Call Agency or Other Locating Service Been Contacted?				
	48.	If Yes to 46 Above, Has the PM and PESM Been Notified?				
	49.	If Yes to 46 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				
	50.	Have Excavation Equipment Come In Contact With Underground utilities?				
	51.	If Yes to 50 Above, Were Intrusive Activities Immediately Curtailed?				
	52.	If Yes to 50 Above, Has a Damage Determination Been Made From a Safe Distance?				
	53.	If Yes to 50 Above, Has the Area Been Secured?				
	54.	If Yes to 50 Above, Have Emergency Responders Been Notified?				
	55.	If Yes to 50 Above, Has the Locating Agency and/or Utility Owner Been Notified?				
	56.	If Yes to 50 Above, Have State and Local Reporting Requirements Been Met?				
	57.	If Yes to 50 Above, Were Intrusive Activities Curtailed Until; Inspection From Utility Owner, Orientation and Depth of Utility Was Determined and Marked, Permission From Emergency Responders Given?				
	58.	If Yes to 50 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				

CHECKLIST COMPLETED BY:

NAME	SIGNATURE	DATE
NAME	SIGNATURE	DATE

FLD 35 ELECTRICAL SAFETY

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GENERAL

REFERENCES

Related FLD OPS:

FLD02 – Inclement Weather
FLD08 – Confined Spaces Entry
FLD26 – Ladders
FLD27 – Scaffolding
FLD34 – Utilities
FLD35 – Electrical Safety
FLD38 – Hand and Power Hand Tools

PROCEDURE

Work areas shall be checked for the presence of high voltage and other hazardous electrical sources. Sources shall be labelled and work areas provided with shielding or located at sufficient distance from electrical sources to prevent contact or arcing to personnel or equipment.

Overhead utilities shall be located and steps taken to ensure there will be no adverse contact with overhead utilities prior to positioning or moving any elevated work platform or rig superstructure.

When high-voltage electrical service is required for site or project activities, service shall be connected by certified electricians in accordance with all applicable local and national electrical codes.

Ground fault circuit interrupters shall be used in the absence of properly grounded circuitry or when portable tools must be used around wet areas.

Electric lines, cables, and extension cords must be appropriately guarded and maintained in good condition.

No work will be done on electrical lines or electrically activated equipment until verification is made that service has been disconnected and/or the system has been locked and tagged out, and the individual doing the work has sole possession of a key to the lock on the lock-out hasp.

High Voltage

Whenever possible, electrical equipment and electrical conductive equipment will be guarded or de-energized as a means of engineering control. When it is necessary to work with or around energized power transmission equipment, and use of permanent guarding is infeasible, grounding and personnel protective equipment is required. Work must be done by personnel who have been specially trained to work around high voltage electricity.

1. Live line work or work within the specified safe distances established by Table V-1, 29 CFR 1926.950, must be performed by qualified, competent people.

2. Electrical personnel protective equipment must be non-conductive rubber material with electrical and mechanical protection equal to or better than rubber. Rubber protective equipment must be in accordance with American National Standards Institute (ANSI) J6 series of Standards. For example:

   - Rubber insulated gloves (J6.6).
   - Rubber matting for use around electric equipment (J6.7).
   - Rubber insulated blankets (J6.4).
   - Rubber insulated hoods (J6.1).
   - Rubber insulated line hose (J6.1)
   - Rubber insulated sleeves (J6.5).

   Rubber or equivalent protective equipment must be:

   - Visually inspected by a competent person before each use.
   - Air tested before each use.
   - Laboratory retested periodically.
   - Stored so sunlight or folding will not cause damage or deterioration.

3. Hard hats worn around electrical hazards must be class "B" according to ANSI Standard Z89.2.

4. Body belts, lanyards, and lifelines used around electrical hazards must be able to:

   - Withstand an AC dielectric test of not less than 25,000 volts per foot "dry" for 3 minutes without visible signs of deterioration.

   - Allow less than one (1) milliampere leakage when 3,000 volts is applied 12 inches apart.

5. Hot line tools must be able to withstand voltages of 100,000 volts per foot if fiberglass, or 75,000 volts per foot if wood.

FLD 36 WELDING/CUTTING/BURNING

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GENERAL

REFERENCES

Related FLD OPs:

FLD01 – Noise Protection
FLD02 – Inclement Weather
FLD08 – Confined Spaces Entry
FLD09 – Hot Work
FLD10 – Manual Lifting and Handling of Heavy Objects
FLD12 – Housekeeping
FLD16 – Compressed Gases
FLD22 – Heavy Equipment Operation
FLD24 – Aerial Lifts/Manlifts
FLD29 – Materials Handling
FLD30 – Hazardous Materials Use and Storage
FLD31 – Fire Prevention/Protection/Response Plan
FLD32 – Fire Extinguishers Required and Requirements
FLD34 – Utilities
FLD35 – Electrical Safety
FLD38 – Hand and Power Hand Tools

PROCEDURE

Welding, cutting, and burning shall be performed only by those persons competent by reason of formal training or documented experience.

FLD 38 HAND AND POWER HAND TOOLS

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GENERAL

REFERENCES

Related FLD OPS:

FLD01 – Noise Protection
FLD02 – Inclement Weather
FLD08 – Confined Spaces Entry
FLD09 – Hot Work
FLD10 – Manual Lifting and Handling of Heavy Objects
FLD12 – Housekeeping
FLD16 – Compressed Gases
FLD22 – Heavy Equipment Operation
FLD24 – Aerial Lifts/Manlifts
FLD29 – Materials Handling
FLD30 – Hazardous Materials Use and Storage
FLD31 – Fire Prevention/Protection/ Response Plans
FLD32 – Fire Extinguishers Required and Requirements
FLD34 – Utilities
FLD35 – Electrical Safety

PROCEDURE

Work with other than the simplest non-powered hand tools shall be performed only by those persons competent by reason of formal training or documented experience.

Unsafe hand tools shall not be issued or used. All hand tools will be kept in good repair and used only for the purposes for which they were designed. Wrenches with sprung jaws, where slippage could occur, impact tools with mushroomed heads, and wooden handled tools with cracks or splinters are examples of unsafe hand tools.

Tools having defects that will impair their strength or render them unsafe will be tagged or made inoperable and removed from service.

Guards must be in place during operation on all power tools designed to accommodate them. Guards and safety devices must remain in place on power tools unless removed according to manufacturer's instruction for maintenance by a competent person and must be replaced before use. Belts, gears, shafts, drums, flywheels, chains or other rotating, reciprocating, or moving parts exposed to employee contact, or representing other hazards, must be guarded.

Proper personal protective equipment (PPE) must be used when operating power tools or hand tools that may produce projectiles, cuts or abrasions, dusts, fume, mists, or light, or which pose a risk of harm to arms, legs, or feet if dropped.

Throwing tools or materials from one location to another, from one person to another, or dropping them to lower levels, is not permitted.

Only nonsparking tools will be used in locations where sources of ignition may cause a fire or explosion.

Power tools will be inspected, tested, and determined to be safe for operation prior to use. Continued periodic inspections will be made to ensure safe operating condition and proper maintenance.

Electric powered tools must be approved double-insulated or grounded in accordance with 1926.404.

Rotating or reciprocating portable power tools will have a constant pressure switch that will shut off the power when the tool is released by the operator. A portable power tool may have a lock-on control provided turn-off can be accomplished by a single motion of the same finger or fingers that turned it on.

Hydraulic fluid used in powered tools will retain its operating characteristics at the most extreme temperatures to which it will be exposed.

Manufacturer's safe operating pressures for hydraulic hoses, valves, pipes, filters, and other fittings will not be exceeded.

All hydraulic or pneumatic tools that are used on or around energized lines or equipment will have nonconducting hoses having adequate strength for the normal operating pressures.

Loose and frayed clothing, dangling jewelry, rings, chains, and wrist watches will not be worn while working with any power tool or machine. Long hair will be tied back or otherwise secured.

All woodworking tools and machinery will meet applicable requirements of American National Standards Institute (ANSI) 01.1, Safety Code for Woodworking Machinery.

Extension cords:

- Must meet Underwriter's Laboratory (UL) or other rating criteria according to Occupational Safety and Health Administration (OSHA).
- Use will be limited to essential tasks.
- Must be tested for continuity before each use and must be connected to grounded outlets, or ground fault current interrupters must be used.
- Must be inspected daily for loose insulation, broken or missing plugs, bared wires, or other hazards.
- Grounding of outlets used for portable tools must be confirmed before use.
- Must not be allowed to become tripping or slipping hazards.
- Must not be used for lifting or tying off, and shall be disconnected by pulling on the plug.

Any piece of equipment used for lifting materials or personnel shall be used and maintained in strict accordance with manufacturer's directions and applicable OSHA regulations.

Load limits will be visibly posted on all lifting devices.

Only operators with demonstrated competence shall be permitted to operate lifting devices.

Lifting machinery, and all elements of equipment involved in lifting or supporting loads, must be inspected prior to use and then monthly, at a minimum. Inspections must be performed by a competent person and must be documented.

Revised 11/1999

FLD 47 CLEARING, GRUBBING AND LOGGING OPERATIONS

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Contents:

Purpose
Training
Hazard Evaluation
Evaluation Sequence
Limitations to RFW-Performed Activities
Limitations Due to Environmental Conditions
Procedures and Inspection Checklist
Definitions
Training Outline

Purpose:

This Operating Practice covers safety procedures that must be evaluated and utilized for all types of clearing, grubbing and logging activities (i.e., operations associated with the felling and moving of trees, brush and logs), regardless of the end use of the wood. The primary purpose of this Operating Practice is to evaluate safe practices by WESTON personnel who occasionally must use chain saws and other equipment to perform limited tasks. This practice will cover specifics relative to chain saw use and the use of equipment for logging tasks. Performance of logging activities by WESTON personnel is limited to trained personnel performing small-scale ancillary tasks within the criteria outlined in this Operating Practice. Basic subcontractor compliance requirements can also be found within this Operating Practice. For comprehensive requirements, reference 29 CFR 1910.266.

Training:

Any employee or subcontractor performing logging tasks must provide documentation of training to the Project and/or Site Manager prior to performance of task activities. Subcontractors may document compliance with requirements of 29 CFR 1910.266 by means of individual certificates or by a letter that certifies compliance by all subcontract employees.

Minimal Training Requirements for WESTON Personnel:

Formal and Documented Overview of this Operating Practice and OSHA's Logging Regulation (29 CFR 1910.266). See Attached

WESTON employee training may be Vendor or WESTON-provided.

Project Managers are responsible for verifying that personnel are appropriately trained and prepared to perform tasks necessary.

Hazard Evaluation:

Any logging, clearing or grubbing activity must be evaluated for known and anticipated or potential hazards prior to beginning task. Hazard evaluation must include, but not necessarily be limited to; terrain, weather, tree size and lean, tree configuration and condition (e.g., visible dead wood, rotting, fungal growth, lack of new growth, etc.), potential for throwback during felling and proximity to other workers, utilities and equipment.

Any unusual or unfamiliar hazard must be brought to the attention of the site manager or site safety officer and evaluated prior to performing task. Conditions and tasks beyond the training ability or skill of the employee shall not be conducted.

Evaluation Sequence:

Logging activities are not routine WESTON tasks. As such, logging tasks on WESTON sites must be performance-evaluated in the following sequence:

1. Subcontractor Performed (first option). Assumption is that any clearing, grubbing or logging task can be performed more efficiently and economically by a subcontractor than by WESTON personnel.
2. Mechanical Clearing by WESTON personnel (second option). Assumption is that clearing, grubbing and logging tasks can be more efficiently and safely performed using heavy equipment.
3. Hand and Power Tools by WESTON personnel (last option). After evaluation of above, applies to tasks limited as described below.

Limitations to RFW-Performed activities:

Since WESTON personnel do not typically perform clearing or logging activities, the following limitations on tree felling are necessary to limit employee risk. For those hazards or tasks that exceed the limitations indicated, work must be performed by subcontractor.

Manual Felling:

Limited to trained employees with PPE and other equipment appropriate to the task. All hazards evaluated and work sequence planned prior to task performance. Additional limitations include:

- Tree size limited to less than 12 inches diameter.
- Chain saw bar maximum size limited to 16 inches.
- No climbing or elevated platform cuts unless limited to non-powered hand tools for nuisance limb clearing.
- Felling cuts limited to the Open Face Cut.
- No felling of "Danger Trees" (i.e., standing trees that present employee hazard due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem or limbs, inappropriate direction or lean of the tree, prominent fork in trunk or double trees, creating potential felling hazard, hung or entangled trees and snags that create unreasonable risk to the feller during manual cuts).
- Danger trees as defined are to be removed by mechanical aid or subcontractor.
- No felling of "Spring poles" created during felling unless employee specifically qualified to release created tension, otherwise these must be mechanically removed.
- No felling of trees located within 2 tree length distance to hazards such as active roadways, elevated utility lines, buildings, etc.
- No felling on sloping terrain such that safe felling and retreat is compromised.

Mechanical Felling:

- Tree size limited to less than 12 inches diameter.
- Trees cannot be located within 2 tree length distance to hazards such as active roadways, elevated utility lines, buildings, etc.

- All hazards evaluated and sequence planned prior to task.
- Limited to trained and experienced equipment operators with equipment appropriate to task.
- Compliance with 29 CFR 1910.266 required.

Limitations Due to Environmental Conditions:

Work performed by either subcontract or self-performance must be stopped and employees moved to safe areas when environmental conditions such as, but not limited to, electrical storms, high winds, heavy rain, fog, or snow, extreme cold, or darkness are imminent.

2.1 Clearing, Grubbing and Logging Procedures Checklist

All hand tools, power tools, required safety equipment, and supplies must be inspected before use on each shift. Damaged or missing items must be repaired or replaced before work startup.

Safety Precautions:

- First Aid Kits: WESTON corporate requirements apply.
- Fire Extinguishers: WESTON corporate requirements apply.
- Work Areas: Established and communicated to maintain safe work conditions for each employee.
- Signaling Equipment: Hand or audible, discernable above background noise. Air horn suggested.
- Hand and Power Tools Inspection Requirements:
  - Handles/Guards proper and in place.
  - Controls operational.
  - Impact and driving tools in proper condition.
  - Cutting edges sharp and properly shaped.
  - All safety devices in place and operational (chain brakes, throttle return springs, etc.).
- Operation and Maintenance manuals available on-site for machines such as chain-saws and chippers.
- For USACE field operations, compliance with EM 385-1-1, Section 31 is required.

Personal Protective Equipment:

- Hand Protection: Adequate for protection from puncture wounds, cuts, lacerations.
- Leg Protection: Chain saw operators must wear cut-resistant (e.g., ballistic nylon or equivalent) leg protection which covers full length from thigh to the top of the boot for each leg (for subcontracted operations see exceptions in 29 CFR 1910.266(d) if necessary).
- Foot Protection: Water-proof or water repellent, cover and support the ankle. If operating a chain saw, material must be cut-resistant (e.g., multiple layers of material such as ballistic nylon, kevlar, etc.). Cut-resistant material can be intrinsic to the boot construction or as an approved supplemental attachment.
- Head Protection: Hard hats required.
- Hearing Protection: Hearing protection capable of reducing the noise level to less than 85 dBA will be required.
- Eye Protection: Safety glasses required.
- Face Protection: ANSI approved safety glasses and face shield required when operating chipper. Face shield (e.g. mesh screen or ANSI clear) required when operating chain saw, unless determined that use of face shield creates greater hazard.

Chain Saw Use Checklist:

- ❑ Chain saws meet requirements of ANSI B175.1-1991 "Safety Requirements for Gasoline Powered Chain Saws".
- ❑ Select appropriate size and type based upon hazard evaluation and operating procedure.
- ❑ Read and understand operation manual for saw in use.
- ❑ Ensure appropriate PPE available, inspected and used.
- ❑ Ensure chain saw chain is properly sharpened and tensioned on the bar.
- ❑ Ensure proper lubrication.
- ❑ Ensure proper fuel mixture based upon manufacture's direction.
- ❑ Follow inspection procedures defined by manufacture and regulation.
- ❑ Evaluate hazards as defined and determine retreat path.
- ❑ Choose appropriate felling method based upon tree in question and conditions.
- ❑ Clear felling area and retreat path.
- ❑ Perform felling task as planned and trained.
- ❑ Perform limbing and bucking only as necessary and in accordance with hazard evaluation and training.
- ❑ Only authorized personnel will operate chain saws.
- ❑ Chain saw fueled minimum 10 feet from open flame or other ignition source.
- ❑ Chain saw started minimum 10 feet from fueling area.
- ❑ Chain saw started only on the ground or where otherwise firmly supported. No drop-starting.
- ❑ Chain saw shut down or chain brake engaged during retreat after felling or if saw carried further than 50 feet or at anytime terrain or other conditions create employee hazard.

2.2 Chipper Operations Requirements

- ❑ Read and understand operation manual. Note that WESTON will additionally follow the requirements of the Corps of Engineers Safety Manual, EM 385-1-1, Section 31.D.03 as relates to chipper use and safety requirements.
- ❑ Ensure appropriate PPE available, inspected and used. Note that PPE includes full-face eye protection (safety glasses and face shield) meeting requirements of Subpart I of 29 CFR 1910.133. The use of logger-type mesh screen shields are not acceptable for chipping operations.
- ❑ All chippers equipped with appropriate guardsChipper access covers or doors are not to be opened until drum or disc is at complete stop.
- ❑ Inlet and discharge ports on chippers shall be guarded to prevent contact with the disc, knives, or blower blades.
- ❑ Chipper shall be shut down and locked out prior to servicing or maintenance in accordance with manufacture and 29 CFR 1910.147.
- ❑ Chippers shall be chocked to prevent rolling or sliding as necessary.

Definitions:

Clearing, Grubbing: operation refers to the removal of stumps, brush and other vegetation by hand or machine.

Logging Operations: operations associated with felling and moving trees and logs from the stump to the point of delivery, such as, but not limited to; marking, felling, bucking, limbing, debarking, chipping, yarding, loading, unloading, storing, and transporting machines, equipment and personnel from one site to another.

Throwback or Crown Shatter: occurs when either the crown or top of the felled tree or nearby tree snaps off or shatters, hurling branches in various directions. Throwback can also refer to the process when a portion of the felled tree (or portions of other trees contacted during the felling process) causes branches or other pieces of the tree to spring back in directions opposite the felling line.

Felling: the act of cutting down trees.

Spring Pole: a tree, segment of a tree, limb, or sapling that is under stress or tension due to the pressure or weight of another object.

Limbing: to cut the limbs from the tree.

Bucking: to cut the felled tree or limbs into smaller pieces.

Open-Face Cut: is the notch cut on the side of the tree on which it is expected to fall. The open-face notch refers to the combination of the top and bottom cuts meeting such that the resulting angle is from 70 to 90 degrees open.

Backcut or felling cut: the final cut in a felling operation, made horizontally on the opposite side from the notch cut (see open-face cut).

Hinge: is the wood fibers left between the notch cut and felling cut. The hinge is left in the felling process to direct the fall, allow the tree to stay on the stump longer and keep the tree from twisting and/or falling in the wrong direction.

Danger Tree: a standing tree that presents a hazard to employees due to conditions such as, but not limited to; deterioration or physical damage to the root system, trunk, stem or limbs, and the direction and lean of the tree.

Training Outline: WESTON Personnel

Frequency of training:

Under 29 CFR 1910.266, training requirements under the logging standard must be provided as follows:
1. Prior to initial assignment for tasks involving the logging standard.
2. Whenever the employee is assigned new tasks, equipment, vehicles or machines.
3. Whenever an employee demonstrates unsafe job performance.

Minimal Outline and Materials:

Handouts: Copy of Field Operating Procedure (Fld 47).
Available for Instructor: Copy of 29 CFR 1910.266
Video: (LC02)
Estimated contact time: 60 minutes.

Minimal Content:

1. Review all areas of Field Operating Practice for Clearing, Grubbing and Logging.
2. View and discussion of Video (LC02).

3. Outline Major categories (subparagraphs and appendices as follows) of OSHA 29 CFR 1910.266. (Minimal discussion for areas not covered in review of Items 1 or 2).

General Requirements for Personal Protective Equipment

First Aid Kits
Seat Belt Use
Fire Extinguishers
Environmental Conditions
Work Areas
Signaling and Signal Equipment
Overhead Utility Lines
Flammable and Combustible Liquids
Explosives and Blasting Agents

Hand and Power Tools

General Requirements
Chain Saws
Machines

Tree Harvesting Procedures

General Requirements
Manual Felling
Bucking and Limbing
Chipping
Loading and Unloading

Training

Appendix A (First Aid Kits)

Appendix B (First aid and CPR Training)

On the Job Training for Chain Saw and Chipper Operations:

Provided by experienced personnel. Training will consist of:
Review of Operations Manual
Review of equipment and protective equipment requirements.
Observation for competency during task operations.

1.6 DRILLING SAFETY GUIDE

INTRODUCTION

The organization where you work is interested in your safety, not only when you are working on or around a drill rig, but also ,when you are traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools. This safety guide is for your benefit.

Every drill crew should have a designated safety supervisor. The safety supervisor should have the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to listen to the safety directions of the safety supervisor.

Governmental Regulations

All local, state, and federal regulations or restrictions, currently in effect or effected in the future, take precedence over the recommendations and suggestions that follow. Government regulations will vary from country to country and from state to state.

The Safety Supervisor

The safety supervisor for the drill crew, in most cases, will be the drill rig operator.

- The safety supervisor should consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
- The safety supervisor should be the leader in using proper personal safety gear and set an example in following the rules that are being enforced on others.
- The safety supervisor should enforce the use of proper personal protective safety equipment and take appropriate corrective action when proper personal protective safety equipment is not being used.
- The safety supervisor should understand that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide the environment to promote and enforce safety.
- Before drilling is started with a particular drill, the safety supervisor must be ensured that the operator (who may be the safety supervisor) has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- The safety supervisor should inspect the drill rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and or damaged pressure gauges and pressure relief valves.

- The safety supervisor should check and test all safety devices, such as emergency shutdown switches, at least daily and preferable at the start of a drilling shift. Drilling should not be permitted until all emergency shutdown and warning systems are working correctly. Do not wire ground, bypass or remove an emergency device.

- The safety supervisor should check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds on each starting of an engine.

- The safety supervisor should ensure that all new drill rig workers are informed of safe operating practices on and around the drill rig and should provide each new drill rig worker with a copy of the organization's drilling operations safety manual, and, when appropriate, the drill rig manufacturer's operations and maintenance manual. The safety supervisor should ensure that each new employee reads and understands the safety manual.

- The safety supervisor should carefully instruct a crew worker in drilling safety and observe the new worker's progress towards understanding safe operating practices.

- The safety supervisor should observe the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. The safety supervisor should dismiss any worker from the drill site whose mental and physical capabilities might cause injury to the worker or coworkers.

- The safety supervisor should ensure that there is a first-aid kit and a fire extinguisher on each drill rig and on each additional vehicle, and ensure that they are properly maintained.

- The safety supervisor (and as many crew members as possible) should be well trained and capable of using first-aid kits, fire extinguisher, and all other safety devices and equipment.

- The safety supervisor should maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.) and inform other members of the drill crew of the existence and location of the list.

Individual Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling projects, individual protective equipment should include a safety hat, safety shoes, safety glasses and close fitting but comfortable, without loose ends, straps, draw strings or belts, or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry should not be worn during a work shift.

Safety Head Gear

Safety hats (hard hats) should be worn by everyone working or visiting at or near a drilling site. All safety hats should meet the requirements of ANSI Z89.1. All safety hats should be kept clean and in good repair with the headband and crown straps properly adjusted for the individual drill rig worker or visitor.

Safety Shoes or Boots

Safety shoes or boots should be worn by all drilling personnel and all visitors to the drill site observing drilling operations within close proximity of the drill rig. All safety shoes or boots should meet the requirements of ANSI Z41.1.

Gloves

All drilling personnel should wear gloves for protection against cuts and abrasion, which could occur while handling wire rope or cable and from contact with sharp edge and burrs on drill rods and other drilling or sampling tools. All gloves should be close fitting and not have large cuffs or loose ties that can catch on rotating or translating components of the drill rig.

Safety Glasses

All drilling personnel should wear safety glasses. All safety glasses should meet the requirements of ANSI Z87.1.

Other Protective Equipment.

For some drilling operations, the environment or regulations may dictate that other protective equipment be used. The requirement for such equipment must be determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face or ear protection or reflective clothing. Each drill rig worker should wear noise reducing ear protectors when appropriate. When drilling is performed in chemically-or radiologically-contaminated ground, special protective equipment and clothing may and probably will be required. The design and composition of the protective equipment and clothing should be determined as a joint effort of management and the client who requests the drilling services.

Housekeeping On and Around the Drill Rig

The first requirement for safe field operations is that the safety supervisor understands and fulfills the responsibility for maintenance and "housekeeping" on and around the drill rig.

- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.

- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig.

- Pipe, drill rods, casing, augers, and similar drilling tools should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.

- Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.

- Work areas, platforms, walkways, scaffolding and other accessways should be kept free of materials, debris and obstructions, and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.

- Controls, control linkages, warning and operation lights, and lenses should be stored free of oil, grease, and/or ice.

- Gasoline should not be stored in any portable container other than a non-sparking, red container with flame arrester in the fill spout and having the word "gasoline" easily visible.

Maintenance Safety

Good maintenance will make drilling operations safer. Maintenance should be performed safely.

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.

- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fitting (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidentally starting of an engine during maintenance by removing or tagging the ignition key.

- Always block the wheels or lower the leveling jacks or both, and set hand brakes before working under a drill rig.

- When possible and appropriate, release all pressure on the hydraulic systems, the drilling fluid system, and the air pressure systems of the drill rig prior to performing maintenance. Reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs, radiator caps, and other pressurized plugs and caps.

- Do not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have had adequate time to cool.

- Never weld or cut on or near a fuel tank.

- Do not use gasoline or other volatile, flammable liquids as a cleaning agent on or around a drill rig.

- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants.

- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps, chains or cables that have been removed for maintenance before returning the drill rig to service.

Safe Use of Hand Tools

There are almost an infinite number of hand tools that can be used on or around a drill rig and in repair

shops. "Use the tool for its intended purpose" is the most important rule of proper use. The following are a few specific and some general suggestions that apply to safe use of several hand tools often used on and around drill rigs:

- Wear safety glasses and require all others around you to wear safety glasses when using a hammer.
- Wear safety glasses and require all others around you to wear safety glasses when using a chisel.
- Keep all tools cleaned and orderly stored when not in use.
- Use wrenches on nuts - don't use pliers on nuts.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut - first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and when possible apply force to the wrench with both hands while both feet are firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing - check the place where you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease that would otherwise build up and cause wrenches to slip.
- Never use pipe wrenches in place of a rod holding device.
- Replace hook and heel jaws when they became visibly worn.
- Position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform when breaking tool joints on the ground or on the drilling platform; the wrench may slip or the joint may suddenly let go.

Clearing the Work Area

Prior to drilling, adequate site clearing and leveling should be performed to provide a safe working area for the drill rig and supplies. Drilling should not be commenced when tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

Start-up

- All drill rig personnel and visitors are instructed to "stand clear" of the drill rig immediately prior to and during starting of an engine.
- Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct nonactuating positions, and the cathead rope is not on the cathead before starting a drill rig engine.

- Start all engines according to the manufacturer's manual.

Safety During Drilling Operations

Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the drill rig from hole to hole with the mast (derrick), in the raised position.

- Before raising the mast (derrick), check for overhead obstructions. (Refer to Section 2.5.11 an Overhead and Buried Utilities.)

- Before raising the mast (derrick), ensure all drill rig personnel (with exception of the operator) and visitors are cleared from the areas immediately to the rear and the sides of the mast. All drill rig personnel and visitors should be informed that the mast is being raised prior to raising it.

- Before the mast (derrick) of a drill rig is raised and drilling is commenced, level, and stabilize the drill rig with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set-up. Lower the mast (derrick) only when the leveling jacks are down, and do not raise the leveling jack pods until the mast (derrick) is lowered completely.

- Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.

- The operator of a drill rig will only operate a drill rig from the controls. If the operator of the drill rig must leave the area of the controls, the operator should shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator should shut down the drill engine before leaving the vicinity of the drill.

- Throwing or dropping tools is not permitted. All tools should be carefully passed by hand between personnel or a hoist line should be used.

- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.

- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic, and some cannot be detected by smell.

- Clean mud and grease from your boots before mounting a drill platform, and use hand holds and railings. watch for slippery ground when dismounting from the platform.

- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.

- Drain all air and water lines and pumps when not in use if freezing weather is expected.

- Cover all unattended boreholes or otherwise protect to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. All open boreholes should be covered, protected, or backfilled adequately according to local or state regulations on completion of the drilling project.

- Do not "horse around" within the vicinity of the drill rig and tool and supply storage areas even when the drill rig is shut down.

- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

An elevated derrick platform should be used with the following precautions:

- When working on a derrick platform, use a safety belt and a lifeline. The safety belt should be at least 4 in. (100 mm) wide and should fit snugly but comfortably. The lifeline, when attached to the derrick, should be less than 6 ft (2 m) long. The safety belt and lifeline should be strong enough to withstand the dynamic force of a 250 lb (115 kg) weight (contained within the belt) falling 6 ft (2 m).

- When climbing to a derrick platform that is higher than 20 ft (6 m), use a safety climbing device.

- When a rig worker is on a derrick platform, fasten the lifeline to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.

- When a rig worker first arrives at a derrick platform, inspect the platform for broken members, loose connections and loose tools, or other loose materials.

- Securely attach tools to the platform with safety lines. Do not attach a tool to a line attached to your wrist or any other part of your body.

- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.

- Do not leave loose tools and similar items on the derrick platform or on structural members of the derrick.

- Ensure that a derrick platform over 4 ft (1.2 m) above ground surface has toe boards and safety railings that are in good condition.

- When working on the ground or the drilling floor, avoid being under rig workers on elevated platforms, whenever possible.

Be careful when lifting heavy objects:

- Before lifting any object without using a hoist, make sure the load is within your personal lifting capacity. If it is too heavy, ask for assistance.

- Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.

- If a heavy object must be moved some distance without the aid of machinery, keep your back straight and unarched. Change directions by moving your feet, not by twisting your body.

- Move heavy objects with the aid of hand carts whenever possible.

Drilling operations should be terminated during an electrical storm, and the complete crew should move away from the drill rig.

Overhead and Buried Utilities

The use of a drill rig on a site within the vicinity of electrical power lines and other utilities requires that special precautions be taken by both supervisors and members of the exploration crew. Electricity can shock, burn, and cause death.

- Locate, note, and emphasize all overhead and buried utilities on all boring location plans and boring assignment sheets.

- When overhead electrical power lines exist at or near a drilling site or project, consider all wires to be alive and dangerous.

- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or deenergize (turn off) the power.

- Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine what the minimum distance from any point on the drill rig to the nearest power line will be when the mast is raised and/or being raised. Do not raise the mast or operate the drill rig if this distance is less than 20 ft (6 m), or if known, the minimum clearance stipulated by federal, state, and local regulations.

- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.

- Move the drill rig with the mast (derrick) down to avoid contact with power lines.

- If there are any questions whatever concerning the safety of drilling on sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.

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Underground electricity is as dangerous as overhead electricity. Be aware and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer and water. Ask for assistance:

- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign: call the utility and check it out. The underground utilities may be considerable distance away from the warning sign.

- Always contact the owners of utility lines or the nearest underground utility location service before drilling. Determine jointly with utility personnel the precise location of underground utility lines, mark and flag the locations, and determine jointly with utility personnel what specific precautions must be taken to ensure safety.

Safe Use of Electricity

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFP A70-1984) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned to ensure that the work area and operating positions are well lit without shadows or blind spots. The following specific recommendations emphasize the safe
use of electricity during land-bored drilling operations:

- Before working on an electrical power or lighting system, lock out the main panel box with your own lock and keep the key on your person at all times.

- Install all wiring using high quality connections, fixtures and wire, insulated and protected with consideration of the drilling environment. Makeshift wiring and equipment should not be permitted.

- All lights positioned directly above working areas should be enclosed in cages or similar enclosures to prevent loose or detached lamps or vapor tight enclosures from failing on workers.

- Install all lights to produce the least possible glare or "blind spots" on tools, ladders, walkways, platforms, and the complete working area.

- Locate and guard all electrical cables to prevent damage by drill operations or by the movement of personnel, tools, or supplies.

- Ensure that all plug receptacles are the three-prong, U-blade, grounded type and have adequate current carrying capacity for the electrical tools that may be used.

- Ensure that all electric tools have three-prong, U-blade, ground wire plugs and cords.

- Do not use electrical tools with lock-on devices.

- Ensure that all electrical welders, generators, control panels, and similar devices are adequately grounded.

- Avoid attaching electrical lighting cables to the derrick or other components of the drill rig. If this must be done, use only approved fasteners. Do not "string" wire through the derrick.

- Do not use poles used to hold wiring and lights for any other purpose.

- Power should be turned off before changing fuses or light bulbs.

- When a drilling area is illuminated with electrical lighting, wear safety head gear that protects the worker's head, not only against falling or flying objects, but also against limited electrical shock and burn according to ANSI Z89.1 and Z89.2.

- Ensure that all electrical equipment is operated by trained, designated personnel.

- If you are not qualified to work on electrical devices or on electric lines, do not go near them.

React to Contact with Electricity

If a drill rig makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, the human body, if it simultaneously comes in contact with the drill rig and the ground, will provide a conductor of the electricity to the ground. Death or serious injury can be the result. If a drill rig or a drill rig carrier
makes contact with overhead or underground electrical lines:

- Under most circumstances, the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. Do not move or touch any part, particularly a metallic part, of the vehicle or the drill rig.

- If it is determined that the drill rig should be vacated, then all personnel should jump clear and as far as possible from the drill. Do not step off - jump off, and do not hang on to the vehicle or any part of the drill when jumping clear.

- If you are on the ground, you should stay away from the vehicle and the drill rig, do not let others get near the vehicle and the drill rig, and seek assistance from local emergency personnel such as the police or a fire department.

- When an individual is injured and in contact with the drill rig or with power lines, only rescue with extreme caution. If a rescue is attempted, use a long, dry, unpainted piece of wood or a long, dry, clean rope. Keep as far away from the victim as possible and do not touch the victim until the victim is completely clear of the drill rig or electrical lines.

- When the victim is completely clear of the electrical source and is unconscious and a heart beat (pulse) cannot be detected, cardiopulmonary resuscitation (CPR) should be begun immediately.

Safe Use of Wire Line Hoists, Wire Rope and Hoisting Hardware

The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron and Steel Institute Wire Rope Users Manual.

- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for: abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes that have not been used for a period of a month or more should be thoroughly inspected before being returned to service.

- End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.

- If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to ensure that the swivel freely rotates under load.

- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 ft (0.3 m) of the drill rod column above the top of the mast (derrick), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to brake the fall of the rods with your hands or by tensioning the slipping device.

- Most sheaves on exploration drill rigs are stationary with single part line. The number of parts of line should not ever be increased without first consulting with the manufacturer of the drill rig.

- Wire ropes must be properly matched with each sheave - if the rope is too large, the sheave will pinch the wire rope - if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger sized wire rope.

The following procedures and precautions must be understood and implemented for safe use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.

- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope apply loads smoothly and steadily.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Periodically inspect and test clutches and brakes of hoists.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves and pinch points as slack is being taken up, and when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replace wire ropes with ones that conform to the drill rig manufacturer's specifications.

Safe Use of Cathead and Rope Hoists

The following safety procedures should be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. The cathead should be cleaned with a wire brush if it becomes rusty.

- Check the cathead periodically, when the engine is not running, or rope wear grooves. If a rope groove forms to a depth greater then 1/8 inch (3 mm), the cathead should be replaced.

- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.

- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.

- Protect the rope from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.

- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg, or any other part of your body.

- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.

- Never operate a cathead (or perform any other task around a drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.

- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.

- Do not use more rope wraps than are required to hoist a lead.

- Do not leave a cathead unattended with the rope wrapped on the drum.

- Position all other hoist lines to prevent contact with the operating cathead rope.

- When using the cathead and rope for driving or backdriving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.

- The cathead operator must operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

Safe Use of Augers

The following general procedures should be used when starting a boring with continuous flight or hallow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.

- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.

- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.

- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation central at all times until the auger has penetrated about one foot or more below ground surface.

- Use the auger guide to facilitate the starting of a straight hole through hard ground or a pavement.

The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and - disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

- Only use the manufacture's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.

- Whenever possible, use tool hoists to handle auger sections.

- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never allow feet to get under the auger section that is being hoisted.

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.

- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.

- Do not remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.

Safety During Rotary And Core Drilling

Rotary drilling tools should be safety checked periodically and replaced when necessary.

- Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.
- Drill rod chuck jaws should be checked periodically and replaced when necessary.
- The capacities of hoists and sheaves should be checked against the anticipated weight to the drill rod string plus other expected hoisting loads.

Special precautions that should be taken for Safe rotary or core drilling involve chucking, joint break, hoisting, and lower of drill rods:

- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.
- Drill rods should not be held or lowered into the hole with pipe wrenches.
- If a string of drill rods are accidentally or inadvertently released into the hole, an attempt should not be made to grab the falling rods with your hands or a wrench.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.
- If work must progress over a portable drilling fluid (mud) pit, no one should attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

Safety During Travel

The individual who transports a drill rig on and off a drilling site should:

- Be properly licensed and should only operate the vehicle according to federal, state, and local regulations.

- Know the traveling height (overhead clearance), width, length, and weight of the drill rig with carrier and know highway and bridge load, width and overhead limits, making sure these limits are not exceeded with an adequate margin.

- Never move a drill rig unless the vehicle brakes are in sound working order.

- Allow for most overhang when cornering or approaching other vehicles or structures.

- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.

- Watch for low hanging electrical lines, particularly at the entrances to drilling sites, restaurants, motels, or other commercial sites.

- Never travel on a street, road, or highway with the mast (derrick) of the drill rig in the raised or partially raised position.

- Remove all ignition keys when a drill rig is left unattended.

Loading and Unloading

When loading or unloading a drill rig on a trailer or a truck:

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the drill rig with carrier - including tooling.

- Load and unload on level ground.

- Use the assistance of someone on the ground as a guide.

- Check the brakes on the drill rig carrier before approaching loading ramps.

- Distribute the weight of the drill rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the hitch of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.

- Secure drill rig and tools to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

Off-Road Movement

The following safety suggestions relate to off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts and similar obstacles.

- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Do not attempt to cross obstacles such as small logs and small erosion channels or ditches at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the drill has been moved to a new drilling site, set all brakes and/or locks. When grades are steep, block the wheels.
- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

Tires, Batteries and Fuel

Tires on the drill rig must be checked daily for safety and during extended travel for loss of air, and they must be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be reinflated to normal pressures before movement on firm or hilly ground or on streets, roads, and highways. Under-inflated tires are not as stable on firm ground as properly-inflated tires. Air pressures should be maintained for travel on streets, roads, and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:

- Missing or loose wheel lugs.
- Objects wedged between duals or embedded in the tire casing.
- Damage to or poorly fitting rims or rim flanges.
- Abnormal or uneven wear and cuts, breaks, or tears in the casing.

The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacture's repair manual.

Batteries contain strong acid. Use extreme caution when servicing batteries.

- Service batteries in a ventilated area while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger loads to the battery posts. Cell caps should be loosened prior to charging to permit the escape of gas.
- Spilled battery acid can burn your skin and damage your eyes. Immediately flush spilled battery acid off of your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte, use a flashlight (not an open flame) to check electrolyte levels, and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.

Special precautions must be taken for handling fuel and refueling the drill rig or carrier.

- Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.
- Do not fill fuel tanks while the engine is running. Turn off all electrical switches.
- Do not spill fuel on hot surfaces. Clean any spillage before starting an engine.
- Wipe up spilled fuel with cotton rags or cloths - do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, and flames or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- Keep fuel containers and hoses in contact with a metal surface during travel to prevent the buildup of static charge.

First Aid

At least one member of the drill crew, preferably the drilling safety supervisor, should be trained to perform first aid. First aid is taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. It is suggested that courses provided or sponsored by the American Red cross or a similar organization would best satisfy the requirements of first aid training for drill crews.

For drilling operations, it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crew members by instructors qualified by an agency such as the American Red Cross.

A first aid kit should be available and well maintained on each drill site.

Drill Rig Utilization

Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes that they are intended and designed.

Drill Rig Alterations

Alterations to a drill rig or drilling tools should only be made by qualified personnel and only after consultation with the manufacturer. Drill Rig Inspection Checklist can be found in Section 3 of this Safety Officer Field Manual.

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Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 2
Revised Pages for Volume 1

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached 2 copies of the Consent Order Plans and Reports (COPR), Volume 2. The plans provided in Volume 2 include:

- Quality Assurance Project Plan (QAPP)
- Sampling and Analysis Plan (SAP)
- Health and Safety Plan (HASP)

Two copies of the COPR, Volume 1, were submitted to the U.S. EPA on 9 October 2002. The plans that were provided in Volume 1 included:

- Project Management Plan (PMP)
- Data Management Plan (DMP)
- Community Relations Plan (CRP)
- Institutional Control Plan (ICP)

The submission of Volumes 1 and 2 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b, Section VI, Paragraph 15; and Section 2 and Table 1 of Attachment 2 of the Consent Order. The remaining plans and reports will be submitted to the U.S. EPA in subsequent volumes.

Weston Solutions, Inc. (WESTON®) received comments on the COPR, Volume 1, from the U.S. EPA on 21 October 2002. Two copies of responses to the comments and revised pages for the COPR, Volume 1, are attached to this letter. These revised pages replace the original pages of the respective plans.

If you have any questions or comments regarding this submittal, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas S. Cornuet

Thomas S. Cornuet
Project Manager

Attachment

cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON

Quality Assurance Project Plan
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

October 2002

Prepared for

WYETH
Florham Park, New Jersey

Prepared by

WESTON SOLUTIONS, INC.
1400 Weston Way
West Chester, Pennsylvania 19380

W.O. No. 02994.002.009

SIGNATURE PAGE

QUALITY ASSURANCE PROJECT PLAN
FOR THE
WORLD KITCHEN, INC. MASSILLON, OHIO, FACILITY
CORRECTIVE MEASURES IMPLEMENTATION
MASSILLON, OHIO, FACILITY

U.S. EPA ID No. OHD
045-205-424

October 2002

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Kenneth Bardo/U.S. EPA Project Manager	Date
U.S. EPA RCRA Enforcement/Permitting Quality Assurance (QA) Coordinator	Date
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W.O. # 02994.002.009

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LIST OF QAPP RECIPIENTS

Name	Title	Company
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Jeffrey Burman	Project Manager	WKI
Thomas Cornuet	Technical Consultant Leader	WESTON
Douglas Godfrey	Plan Author	WESTON
Kenneth Bardo	Project Manager	U.S. EPA
Eric Lang	Laboratory Director	STL

1. PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) for the Massillon, Ohio, World Kitchen, Inc. (WKI) plant (U.S. EPA ID No. OHD 045 205 424) has been prepared to fulfill reporting requirements set forth in Section VI, Paragraph 15; Section IX, Paragraph 39B; and Section 2 and Table 1 of Attachment 2 of the Administrative Order on Consent (Consent Order) between the United States Environmental Protection Agency (U.S. EPA), WKI, and Wyeth (August 2002). This QAPP presents the organization, objectives, planned activities, and specific Quality Assurance/Quality Control (QA/QC) procedures associated with the Corrective Measures Implementation (CMI) for the WKI facility. Specified protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses are described. All the QA/QC procedures are structured in accordance with applicable technical standards, regulations, and guidance. This QAPP has been prepared in accordance with the U.S. EPA Region 5 QAPP policy as presented in the following:

- U. S. EPA Resource Conservation and Recovery Act (RCRA) QAPP Instructions (April 1998).
- *The Use of Field Methods to Support RFI Streamlining,* U.S. EPA, Region 5 Memorandum, June 20, 1997.
- U.S. EPA *Region 5 Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, (April 1993).
- *National Functional Guidelines for Organic Data Review* (September 1994).

1.1 INTRODUCTION

This QAPP has been prepared on behalf of Wyeth and WKI for the WKI, Massillon, Ohio, facility by Weston Solutions, Inc. (WESTON®). A Project Management Plan, Data Management Plan, Community Relations Plan, and Institutional Control Plan were submitted to the U.S. EPA in the Consent Order Plans and Reports (COPR), Vol. 1, on 9 October 2002. A Sampling and Analysis Plan (SAP) and a Health and Safety Plan (HASP) are appended to this QAPP as part of COPR, Vol. 2.

1.1.1 Site Ownership

EKCO Housewares, Inc. owned and operated the Massillon, Ohio, facility until 1965, at which time it was acquired by American Home Products Corporation (AHP). AHP continued to operate the facility until 1984 when it was sold to the EKCO Group. In 1999, the EKCO Group sold the facility to WKI, the current owner of the property. AHP changed its name to Wyeth in March 2002.

1.2 SITE DESCRIPTION

The facility occupies approximately 13 acres in the City of Massillon, Stark County, Ohio (Figure 1-1). The area surrounding the site is largely urban and industrial. Land use to the northwest is more rural with more open space. The property is triangular in shape and lies approximately 1,500 ft west of the Tuscarawas River. The facility is bordered to the north by Newman Creek, while the Penn Central and the Baltimore and Ohio Railroads border the property to the west and east, respectively. The Baltimore and Ohio Railroad has numerous spurs and sidetracks adjacent to the plant, which are used for the storage of rail cars and track maintenance vehicles.

Manufacturing, warehousing, and shipping activities are conducted within a complex of interconnected buildings, which cover approximately 5.6 acres of the 13-acre site. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas. The building locations are shown on Figure 1-2.

A variety of businesses operate in the immediate vicinity of the plant, including: Ohio Packaging (paper supplier) to the south, sand and gravel quarries to the west and northwest, Carter Lumber (retail) and Price Brothers, Inc. (concrete pipe) to the north, and the Consumer Water Service (public water supply) waterworks and an automobile reclamation site to the east and northeast. An inactive municipal landfill reportedly exists just east of Consumer Water Service. The City of Massillon is believed to have been the principal user of the landfill; however, other users may also have been involved. The landfill was apparently informally operated, that is, no weigh station or access control was believed to have been present, and the landfill was not fenced. It is

FIGURE 1-1 SITE LOCATION MAP
WORLD KITCHEN, INC. (EKCO) FACILITY
MASSILLON, OHIO

unclear whether records of ownership, methods of operation, or methods of "closure" have been retained.

1.3 SITE HISTORY AND BACKGROUND

The first recorded activities occurred at the facility in approximately 1929, when the property was owned by Standard Oil Company. From approximately 1929 to 1942 Fort Pitt/Massillon Bridge Works manufactured iron and steel bridges and structural iron. In 1945, the Massillon facility was manufacturing aluminum and stainless steel cookware. By 1951, with the United States' involvement in the Korean Conflict, the plant was manufacturing 90 mm and 105 mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells, W-1 and W-2, at the facility (Figure 1-2). In 1953, a sewer was constructed which carried the plant waste to a discharge point along Newman Creek. At approximately the same time, a surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Wastewaters from manufacturing were discharged to the surface impoundment.

During 1954, the facility began alternate manufacturing operations. The primary function of these operations was returned to manufacturing cookware at the facility. Solvents (primarily trichloroethene [TCE] or 1,1,1-trichloroethane [1,1,1-TCA]) were used to clean the products prior to continuing production. These solvents were used for cleaning purposes until 1994. In 1994, the solvents were replaced with a Borax aqueous cleaner which is still used at the facility. No chlorinated solvents have been used at the facility since 1994.

By 1967, trends in the cookware manufacturing industry had changed, resulting in the installation of porcelain- and Teflon-coating units. In 1969, with the development of new NPDES regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to accept waste products associated with plant activities. These waste products have included:

- Deionizers from plant operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain-Teflon-coated aluminum cookware (aluminum frit, various coloring inorganics oxides, lead, cadmium, selenium, cobalt).

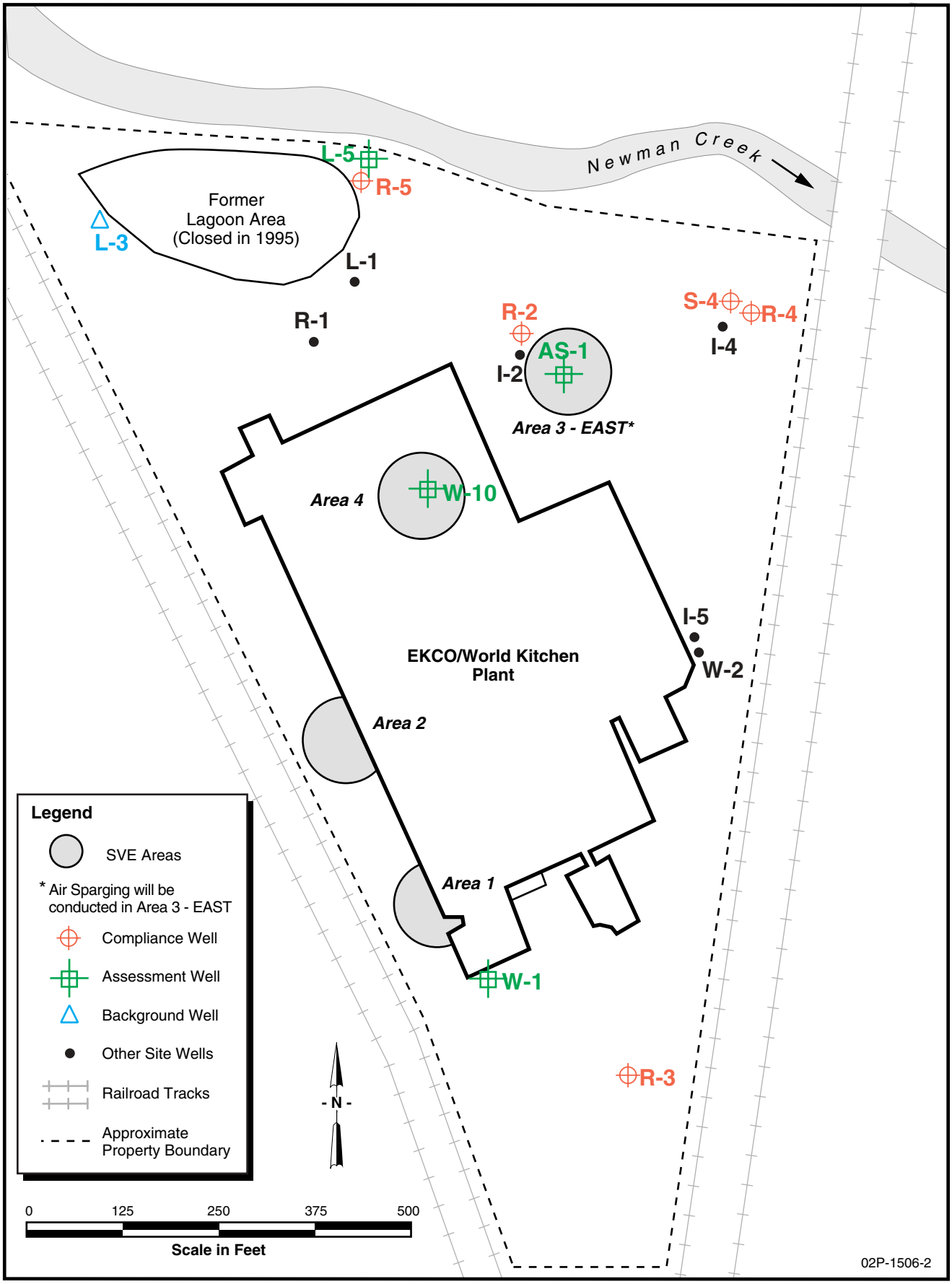

FIGURE 1-2 WORLD KITCHEN, INC. - MASSILLON, OHIO PROJECT GROUNDWATER MONITORING PROGRAM WELLS AND SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING AREAS

- Alkaline washer fluids to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued for the facility. As the 1970's progressed, the facility discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper-coating operations had ended and the principal products manufactured at the facility became pressed and coated non-stick bakeware.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the Corrective Measures Study (CMS). This correction is based on more recent review of historical plant documents.

The surface impoundment was reactivated in 1980 under the existing NPDES permit, and received housing degreaser filter water until mid-1984. The surface impoundment was finally decommissioned in December 1985. In March 1984, when the plant applied for a renewal of their NPDES permit, analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at the facility. The waste stream was diverted from the surface impoundment to discharge in Newman Creek in December 1985. At that time, the surface impoundment (lagoon) was permanently taken out of service.

In 1992, the facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area. During 1993 and 1994, Roy F. Weston, Inc. (WESTON®) was retained by AHP to pursue a clean closure for the lagoon. Closure activities were conducted at the site from August 1993 to June 1994. A closure certification report was submitted to the OEPA in July 1994, and approval of the lagoon closure was issued in January 1995. Now that the lagoon is officially closed, quarterly groundwater sampling of the lagoon wells is no longer required for the RCRA lagoon closure.

WKI (formerly EKCO) continues to manufacture pressed and coated non-stick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface. A detailed description of the historical environmental investigations and a table

summarizing the facility history are provided in the Community Relations Plan in Consent Order Plans and Reports, Volume 1 of 4 (COPR, Vol. 1).

1.4 PROJECT OBJECTIVES AND INTENDED DATA USES

The RCRA Facility Investigation (RFI) results show that soil and groundwater contaminated with volatile organic compounds (VOCs) at the WKI (former EKCO) facility should be remediated. A number of remediation alternatives for cleaning up soil and groundwater contamination were identified and evaluated during the CMS. The alternatives are described and compared in detail in the CMS report, which is available for review at the following location:

Massillon Public Library
208 Lincoln Way East
Massillon, OH 44646
(330) 832-9831.

The project objectives for the facility CMI include the following as defined by the Consent Order Scope of Work:

- Achieving regulatory standards for volatile organic compounds (VOCs) detected in soil and groundwater at the facility.
- Continuing the prevention of contaminant migration from the facility property.

The project closeout procedures are presented in the Project Management Plan and in the Consent Order provided in the COPR, Vol. 1. The Decision Statement for this CMI is:

- The regulatory standards for VOCs detected in soil and groundwater have been achieved at the facility as per the Consent Order Scope of Work.

The groundwater and soil cleanup goals for the project are listed in Tables 1-1 and 1-2, respectively. The process that will be followed to determine when these goals are met is outlined in the Consent Order Scope of Work (COPR Vol. 1).

To ensure that the data generated are of known and acceptable quality, this QAPP makes provisions for: developing standards for performance related to various elements of the scope of work, monitoring actual performance in comparison to and in compliance with the established

Table 1-1

Groundwater Site-Specific Target Compounds
WKI, Massillon, Ohio, Facility

Site Specific Target Compound	Groundwater Performance Standard (µg/L)	Laboratory Reporting Limit (µg/L)
1,1-dichloroethane	810	1
1,1-dichloroethylene	7	1
cis-1,2-dichloroethylene	70	1
trans-1,2-dichloroethylene	100	1
1,1,1-trichloroethane	200	1
Trichloroethylene	5	1
vinyl chloride	2	1

Table 1-2

Soil Site-Specific Target Compounds
WKI, Massillon, Ohio, Facility

Site-Specific Target Compound	Soil Performance Standard (µg/Kg)	Laboratory Detection Limit(µg/Kg)
1,1-dichloroethylene	120	5
1,2-dichloroethylene	1500	5
1,1,1-trichloroethane	6140	5
trichloroethylene	230	5

standards, reporting the monitored performance, and rectifying performance not conforming to the established standards.

In order to accomplish the project objectives, a confirmation level of analytical quality is needed. This provides the highest level of data quality and includes, but is not limited to, evaluation of remediation activities and evaluation of remedial alternatives (if required). These analyses require full documentation of SW-846 analytical methods, sample preparation steps, data packages, and data validation procedures necessary to provide defensible data. QC must be sufficient to define the precision and accuracy of these procedures at every step. QC measures will be implemented throughout the project to ensure that the data meet known and suitable data quality criteria such as accuracy, precision, representativeness, comparability, and completeness. The sampling data will be quality-controlled throughout the collection of field QC samples and the calibration of field and laboratory equipment following U.S. EPA protocols.

The data produced for this facility will be validated according to the procedures outlined in Section 9. The data will be evaluated for compliance with the QC objectives listed in Section 12, and flagged according to the validation flags presented in Section 9.

The Corrective Measures that have been selected and approved by the U.S. EPA to meet the site cleanup goals are summarized below.

1.4.1 Selected Corrective Measures Alternatives

Based on the CMS (November 1993) and the CMS Addendum (July 1994), the U.S. EPA has identified and approved the alternatives that will most effectively clean up VOCs at the facility. The selected cleanup alternatives include measures for cleaning up groundwater and identified areas of soil, including one area beneath and three areas outside the facility building. The site monitor wells and remediation areas are shown in Figure 1-2 on page 1-5. The selected alternatives consist of the components discussed below.

VOCs in the shallow groundwater in Area 3-East will be removed by a process called “air sparging” (AS), also known as “in situ air stripping.” AS is an effective option for treating groundwater contaminated with VOCs. The process transfers VOCs, which evaporate easily

when exposed to air, from a liquid to a vapor phase. A system of injection wells injects air into groundwater. VOCs dissolved in the groundwater will volatilize into the air as the air bubbles move through the impacted groundwater. Soil vapor extraction (SVE) wells are then used to collect vapor-phase VOCs as they migrate upward through the soil subsurface. Once contaminated vapors are removed from the soil subsurface, they are treated using a vapor treatment system such as granular activated carbon (GAC) filters, if necessary.

There is a groundwater extraction and air stripping system currently being used at the facility, which will continue to be operated to provide further groundwater containment and treatment beneath the entire site. Groundwater will continue to be monitored to ensure the effectiveness of treatment. Well permit restrictions and institutional controls will be placed on the property to restrict the placement and pumping of water supply wells in or near the area of the contaminated groundwater, and to restrict the facility to non-residential water use only. The institutional controls and restrictions are further described in the Institutional Control Plan (COPR, Vol. I.).

VOC-impacted soil as located beneath and outside the building will be treated by an SVE system to remove VOCs using the same process described above. Air extraction vents will be installed in each contaminated soil area. The removed VOCs will be treated using GAC filters, if necessary. SVE vents will be installed into all four areas, Area-1, Area-2, Area-3 East, and Area-4, to a total depth of approximately 10 to 25 ft below ground surface (bgs). SVE blowers will be used to create a vacuum on each of the vents and remove contaminants from the subsurface. The system will include monitoring parts, gauges, and valves throughout the system so that contaminant load, pressures, and flow rates can be monitored and adjusted to evaluate and optimize system performance. The AS and SVE operation and maintenance procedures will be described in the Operation and Maintenance Plan.

1.5 TARGET PARAMETER LIST

The groundwater and soil Target Parameter List for this project are the VOCs listed in Tables 1-1 and 1-2, respectively. All of these compounds are critical measurement parameters. These compounds address the specific project objectives discussed in Section 1.4. However, in accordance with the RCRA QAPP Guidance, other potential analytical methods are discussed.

1.6 SAMPLING LOCATIONS

The soil remediation areas and groundwater sampling locations are shown in Figure 1-2. The groundwater and soil monitoring programs for the project are described in the Consent Order Scope of Work. Initially, the groundwater monitoring program will consist of quarterly sampling for VOC analysis of the 10 compliance, assessment, and background wells shown on Figure 1-2. The groundwater monitoring program will start within 90 days of the execution of the Consent Order and the sampling is scheduled to occur during the months of February, May, August, and November.

The soil monitoring program will consist of monitoring air from the SVE vents and collecting confirmation soil samples from the SVE remediation areas. The SVE system air sampling procedures will be described in the Operation and Maintenance Plan. The soil confirmation sampling will consist of advancing three soil borings spaced evenly throughout each SVE remediation area and collecting two samples from each boring.

1.7 PROJECT SCHEDULE

The project schedule is provided in the Project Management Plan and in the Consent Order (COPR Vol. 1). Initially, the groundwater sampling will be conducted quarterly during the months of February, May, August, and November. Quarterly Progress Reports will be submitted by the 15th day of the month following the end of each quarter during the months of February, May, August, and November.

2. PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 CONTACT INFORMATION

At the direction of Wyeth and WKI, Weston Solutions, Inc. (WESTON®) will manage all phases of the project. WESTON will perform the field investigation, prepare the reports, and perform all subsequent studies. Project management will be provided by Matt Basso (Wyeth), Jeff Burman (WKI), and Ken Bardo (U.S. EPA RCRA Project Manager [RPM]). Management responsibilities of key project personnel are defined in Subsection 2.2. Contact information is provided in the following table:

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2.2 ROLES AND RESPONSIBILITIES

The Wyeth Project Manager, Matt Basso, is responsible for implementation of the Consent Order and Scope of Work. The U.S. EPA Region V has approved the Consent Order and Consent Order Scope of Work. The U.S. EPA Project Manager, Ken Bardo, will provide oversight for the project. The WKI Project Manager, Jeff Burman, is responsible for ensuring that Wyeth and any and all employees, agents and contractors of Wyeth, be given access to the facility, and WKI's records relating to the Consent Order, at all reasonable times and at all places necessary for the purpose of performing all of the tasks and responsibilities set forth in this Consent Order and the attachments hereto and for the purpose of conducting oversight of the same.

The WESTON Technical Consultant Leader, Tom Cornuet, is responsible for implementing the project, and has been provided the authority from Wyeth and WKI to commit the resources necessary to meet project objectives and requirements. WESTON's primary function is to ensure that technical, financial, and scheduling objectives are achieved.

The WESTON Technical Consultant Leader will report directly to the Wyeth Project Manager and is responsible for ensuring that the project meets U.S. EPA's objectives and WESTON quality standards. The WESTON Technical Consultant Leader is also responsible for technical quality control (QC) and project oversight.

The WESTON Technical Consultant Leader will be supported by the WESTON field team leader. The WESTON field team leader is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his/her supervision. The WESTON field team leader is a highly experienced environmental professional, who will report directly to the WESTON Project Manager.

The technical staff for this project will be drawn from WESTON's pool of corporate resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

The Laboratory Manager, Eric Lang, will report directly to the WESTON Technical Consultant Leader, Tom Cornuet, and will be responsible for the following:

- Ensuring all resources of the laboratory are available on an as-required basis.
- Overseeing production and final review of analytical reports.

3. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

3.1 QUALITY ASSURANCE OBJECTIVES (QAOs)

QAOs are the detailed QC specifications for precision, accuracy, representativeness, comparability, and completeness (collectively referenced as PARCC). The QAOs established in this QAPP should be used for both sampling and analysis planning and data quality review. In regards to measurement data quality, the QA/QC program shall include the following QAOs:

- Provide a mechanism for the ongoing control and evaluation of measurement data quality.
- Provide measures of data quality in terms of accuracy, precision, completeness, representativeness, and comparability to assess whether the data meet the project objectives and can be used for their intended purpose.

The data quality objectives (DQOs) of the sampling program determine the type and quantity of data needed to make a decision, as well as the measurement objectives (precision, accuracy) for each type of measurement data collected. The DQOs for this project include the following:

- Generate sufficient information to determine the presence or absence of chemical contamination within the site's media.
- Use of information to evaluate the progress of the remedial activities.
- To provide data needed to enable project personnel to determine when site remediation is complete.

The DQOs listed above will be accomplished by ensuring that the following analytical objectives are met. These analytical objectives will be:

- To collect and analyze samples using standard methods.
- To obtain usable and defensible analytical results.

The following sections discuss the steps that will be taken to provide data during the WKI facility remediation work. The representativeness of the measurement data is a function of the SAP and the Data Management Plan sampling strategy and will be achieved by following the

procedures discussed in the QAPP, the Sampling and Analysis Plan (SAP), and the Data Management Plan (DMP). The quality of the analytical results is a function of the analytical system and will be achieved by using standard methods and the quality control system discussed in this section. The basis for assessing precision, accuracy, completeness, representativeness, and comparability is discussed in the following subsections. Specific calculations for data quality measurements, and the data assessment procedure, are presented in Section 12.

3.2 OVERALL QUALITY ASSURANCE OBJECTIVES

The quality assurance objective (i.e., goal) for the WKI facility work is to have all analyses performed on an analytical system that is in statistical control and meets method specifications. Numerically, the goal is to have all individual results traceable to a laboratory control sample whose recovery (for both precision and accuracy) is within method-specified limits. Method specifications will be used as tolerance limits for the project. Laboratory-derived limits used to statistically monitor analytical system control will be within method specifications. The method-specified limits for laboratory control samples are supplied in Section 7 along with method-specified limits for spike recoveries in natural matrix samples. Inaccurate or imprecise recovery of laboratory control samples will potentially invalidate results. Inaccurate or imprecise recovery of spikes in natural-matrix samples will not necessarily invalidate results. Poor recoveries of spikes in natural-matrix samples indicate the potential for matrix effects. A conclusion of matrix effects must be supported by laboratory control sample results within acceptance criteria for the analytical batch for which the matrix spike was performed.

3.3 DEFINITION OF CRITERIA

This section defines how the project analytical measurement data objectives will be assessed during the WKI facility work.

3.3.1 Precision

3.3.1.1 Definition

Precision measures the reproducibility of repetitive measurements. Precision is strictly defined as the degree of mutual agreement among independent measurements as the result of the repeated application of the same process under similar conditions. Analytical precision is a measurement of the variability associated with duplicate (2) or replicate (more than 2) analyses of the same sample in the laboratory and is determined by analysis of matrix spike duplicates or laboratory control sample duplicates. Total precision is a measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and includes all possible sources of variability. Precision will be estimated for the WKI facility work using the relative percent difference (RPD) between duplicate measurements of laboratory control samples and field duplicate samples.

3.3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 analytical samples. The total number of duplicates for this project will be based on the time it takes for the remedial action goals to be satisfied. Precision goals will be met if field duplicates agree within RPDs specified in Table 3-1.

3.3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for three or more replicate samples. The equations to be used for precision in this project can be found in Section 12 of this QAPP. Laboratory precision goals are presented in Table 3-1 for each method and matrix. Precision goals will be met if duplicate analyses of laboratory control samples agree within RPDs specified in Table 3-1. RPDs for laboratory control samples outside specified criteria indicate that the analytical system is out of control and requires batch-related samples to be reanalyzed.

Table 3-1

Laboratory Precision and Accuracy Goals for Site-Specific VOCs and Surrogates
WKI, Massillon, Ohio, Facility

	MS/LCS Tolerance (%)			
	Accuracy (Recovery)		Precision (RPD)	
Analyte	Water	Soil	Water	Soil
Site-Specific VOCs				
1,1-Dichloroethene	54-127	51-132	20	20
1,1,1-Trichloroethane	66-129	63-133	20	20
Trichloroethene	70-120	75-129	20	20
cis-1,2-Dichloroethene	78-126	68-148	20	20
trans-1,2-Dichloroethene	64-119	58-139	20	20
Vinyl chloride	67-137	58-140	20	20
1,1-Dichloroethane	69-127	63-133	20	20
Surrogates				
1,2-Dichloroethene-d4	61-131	50-145	NA	NA
4-Bromofluorobenzene	73-122	60-140	NA	NA
Dibromofluoromethane	66-132	60-140	NA	NA
Toluene-d8	78-128	66-141	NA	NA

NA = Not Applicable.
RPD = Relative Percent Discrepancy
MS/LCS = Matrix Spike/Laboratory Control Sample

For inorganic analyses (if needed), laboratory precision shall be assessed through the analysis of a sample/sample duplicate pair. For organic analyses, laboratory precision shall be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) samples. Precision of the analytical measurement system will not be assessed by matrix spike duplicates nor field duplicates, both of which contain matrix effects which cannot be controlled. Results of these duplicate determinations will be used to evaluate the total precision possible in natural-matrix sample results.

3.3.2 Accuracy

3.3.2.1 Definition

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systematic error (bias). It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value.

3.3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field and trip blanks and adherence to sample handling, preservation and holding times.

3.3.2.3 Laboratory Accuracy Objectives

Analytical method accuracy is typically measured by determining the percent recovery of known target analytes that are spiked into a field sample (a matrix spike) or reagent water or soil (laboratory control sample) before extraction, at known concentrations. Surrogate compound recovery is another spiking technique used to assess method accuracy for each sample analyzed for organic compounds. The stated accuracy objectives apply to spiking levels at five times the method detection limits or higher. The individual methods provide equations for acceptance criteria at lower spiking levels.

Both accuracy and precision are calculated for specific sampling or analytical batches, and the associated sample results must be interpreted considering these specific measures. Application of

calculated precision and accuracy to measurement sample results is discussed in Section 8.1. An additional consideration in applying accuracy and precision is the concentration level of the samples; a procedure capable of producing the same value within 50% would be considered precise for low-level (near the detection limit) analyses of minor constituents, but would be unacceptable, and possibly useless, for major constituents at high concentrations.

Accuracy goals for laboratory control samples are presented in Table 3-1. Accuracy goals will be met if individual laboratory control sample recoveries are within listed criteria. Laboratory control sample recoveries outside criteria indicate the analytical system is out of control and may require samples to be reanalyzed.

3.3.3 Completeness

3.3.3.1 Definition

Completeness is calculated from the aggregation of data for each method for any particular sampling event. For each method and each site, the number of valid results, divided by the number of individual analyte results initially planned for, expressed as a percentage, determines the completeness for the data set.

3.3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The Equation for completeness is presented in Section 12 of this QAPP. The completeness objective is 90%.

3.3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. If there are any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and reanalysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of valid possible results. The laboratory completeness objective is 90%.

Valid results used to meet completeness objectives are those results which provide defensible estimates of the true concentration of an analyte in a sample. These valid results include data which are not qualified and data for which QC results indicate qualification is necessary but which may still be used to meet project objectives. Invalid results are those data for which there is an indication that the prescribed sampling or analytical protocol was not followed.

3.3.4 Representativeness

3.3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness will be achieved through use of the standard sampling and analytical procedures described in this QAPP. The site-specific program design which includes sampling locations and procedures is described in the SAP, the Remediation Design Report, and the Operation and Maintenance Plan.

3.3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent on the proper design of the sampling program and will be satisfied by ensuring that the SAP is followed and that proper sampling techniques are used. In designing the sampling program, media of concern have been specified.

3.3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is provided by using the proper analytical procedures, appropriate methods, meeting sample holding times and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of facility conditions. During development of this network, consideration was given to past site activities, existing analytical data, and physical setting and processes. The rationale of the sampling network is discussed in detail in Section 4.3 of the SAP.

3.4 DECISION RULES

3.4.1 Definition

A Decision Rule is a statement which allows for a course of action or non-action to be taken based on assumptions made to draw out and test its logical or empirical consequences.

3.4.2 Decision Rule Objectives

The Decision Rule objectives address the following:

- Monitor the containment and remediation of the WKI facility using the project decision-making criteria. For this project, samples shall be collected discretely without compositing to provide greater indication of locally contaminated zones. Results will be assessed against the cleanup goals for discontinuing remediation activities.
- Identify action level(s)(e.g., soil, water and air action levels).
- Develop "if/then" statements defining conditions that would cause the decision maker to choose among alternative actions (e.g., continued remediation, discontinuing remediation).

Decision levels, expressed as site-specific performance standards, are specified in Tables 1-1 and 1-2 of this QAPP.

The Decision Rules for this facility can be stated as follows.

1. The pump-and-treat system will remain in operation until concentrations of the target chemicals of concern listed on Table 1-1 are below the groundwater performance criteria for two consecutive sampling events, or as approved by U.S. EPA. The subsequent performance monitoring period will consist of semiannual sampling for 2 years of all compliance wells, bedrock zone production/recovery wells, and the background well to ensure continued cleanup attainment.

   If at the end of the performance monitoring period not all criteria are met, Wyeth will initiate a discussion with U.S. EPA to determine course of action.

2. Air sparging will be discontinued when the laboratory data demonstrate that well AS-1 meets the groundwater performance standards for two consecutive sampling events,

or as approved by U.S. EPA. The air sparging performance monitoring period consists of semiannual sampling for 2 years.

If at the end of the performance period, not all criteria are met, the facility will initiate a discussion with U.S. EPA to determine course of action.

3. Soil remediation will be completed on an area-by-area basis when each of the SVE systems demonstrates a negligible removal rate (<0.2 lb/day) for 2 consecutive months or the removal rate remains within a narrowly defined range for 4 consecutive months, at which time soil confirmation sampling will be performed. The SVE system can be discontinued in an area when the soil confirmation sample results are below the performance standards for all compounds, or as approved by U.S. EPA.

3.5 COMPARABILITY

3.5.1 Definition

Comparability is the confidence with which one data set can be compared to other data sets.

3.5.2 Measures to Ensure Comparability of Data

The objectives for this QA/QC program are to produce data with the greatest degree of comparability possible. The number of matrices that will be sampled and the range of field conditions encountered must be considered in ultimately determining comparability. Comparability will be achieved by using standard methods for sampling and analysis, reporting data in standard units, and using standard and comprehensive reporting formats. Analysis of reference samples may also be used to provide additional information that can be used to assess comparability of analytical data produced within the laboratory and among laboratories, if more than one laboratory is used on the project.

3.6 LEVEL OF QUALITY CONTROL EFFORT

Field blank, trip blank, method blank, field duplicate, laboratory duplicate, laboratory control, standard reference materials (SRM) and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. Table 3-1 lists the QA/QC requirements for the WKI facility.

- Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program.
- Field blank samples are analyzed to check for procedural contamination at the facility which may cause sample contamination.
- Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.
- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures.
- Duplicate samples are analyzed to check for sampling and analytical reproducibility.
- MS/MSDs provide information about the effect of the sample matrix on the digestion and measurement methodology. Depending on site-specific circumstances, one MS/MSD should be collected for every 20 or fewer investigative samples of a given matrix. MS/MSD samples are designated/collected for organic analysis only.

The general level of the QC effort will be one field duplicate and one field blank for every 10 or fewer investigative samples (per matrix). One trip blank consisting of distilled deionized ultra pure water will be included along with each shipment of aqueous VOC samples.

Sampling procedures are specified in Section 4.4 of the SAP.

4. SAMPLING PROCEDURES

This section describes the components of the sampling procedures that will be performed to meet the QAO for the remediation tasks to be performed at the WKI facility.

4.1 SAMPLING PROTOCOLS

This section includes brief descriptions of field procedures used to conduct environmental investigations and characterizations. Criteria or guidelines for choosing among alternatives are also included when more than one procedure can be used. Detailed equipment and sampling protocols are provided and discussed in the SAP (COPR, Vol. 2) and the Operation and Maintenance Plan (COPR, Vol. 4), which will be submitted upon installation and startup of the remediation system. The detailed equipment and sampling procedures discussed in these plans present the QC specifications, documentation requirements, field forms, stepwise descriptions of the procedure, and any special conditions or precautions for field activities.

The sampling design includes the sampling network design, sample types, sampling frequency, sample matrices, and analytical methods. The rationale and procedures are selected for use during the DQO development process and are documented in the SAP (COPR, Vol. 2). The sampling design includes the sampling locations and specific sample collection criteria. Field personnel will read and understand pertinent sections of the QAPP before planning or performing the field work. Field personnel will also have a copy of the SAP while in the field. All field activities will be conducted following health and safety procedures described in the HASP (COPR, Vol. 2).

Proper site sampling location selection is critical to producing representative data. Locations selected for drilling and/or sampling during the DQO process shall represent the site, zone, and/or matrix under investigation. The general criteria described below are considered when selecting drilling and sampling locations.

Criteria for selecting locations are based on the specific objectives for each drilling or sampling effort. The selected locations may include the following general criteria:

- The need to determine presence or absence of contamination in the vadose and/or saturated zones.
- The need to determine geology and physical parameters of the vadose and/or saturated zones.
- Current or historic groundwater gradients and flow directions.
- Proximity to past waste disposal sites.
- Proximity to receptors such as water supply wells.
- Favorable access for drilling equipment.
- Presence of overhead power or telephone lines or other structures.
- Location of underground structures, such as sewer lines, power lines, and water lines.

Final selection of a site sampling location depends upon securing all necessary rights-of-entry, clearances, and permits. Electrical cable and pipe locator instruments, utility maps, magnetometer readings, and ground penetrating radar can be used to determine if utilities underlie the drilling location.

Monitor well and soil boring locations can also be based on review of available hydrogeologic and analytical data.

Sampling locations for subsurface soil and groundwater are selected using a biased or statistical sampling approach. The DQOs, intended data uses, and knowledge about the areas under investigation dictate which approach is most appropriate. General criteria used to select sampling locations may include the following:

- Known or suspected contaminant release area.
- Visible staining, odor, field measurement, or other indication of contamination.
- A grid established over the area with designated or random cells to be sampled.
- A designated number of samples to be collected per boring.
- Geoprobe® groundwater samples collected when borings penetrate below the water table.

The specific site selection criteria, number of samples to be collected and parameters of interest are addressed in the SAP.

4.2 SAMPLING METHOD REQUIREMENTS

Several elements of field and sampling activities are comprehensive and apply to all types of procedures. The standard approach for each element is addressed in the SAP.

During the project, the Technical Consultant Leader and sampling team members will see that all measurement and field procedures are followed as specified in the SAP, and measurements meet the prescribed acceptance criteria. If a problem arises, prompt action to correct the problem will be initiated. Corrective action procedures are described in Section 13 of this QAPP.

4.3 SAMPLE HANDLING

The field sampling team will be responsible for ensuring that samples are collected with properly decontaminated equipment and containerized in properly cleaned sample bottles. All sample bottles and containers will be precleaned according to EPA protocols.

Sampling and preservation procedures will be as mandated by each respective method. In order to preserve the integrity of the sample before it is analyzed, proper sample containment, preservation methods, holding times and shipping and chain-of-custody procedures must be followed. A summary of the recommended sample containers, sample volume, preservation, and hold times for each analytical method and sample matrix is provided in Table 4-1. A temperature blank will be included with each cooler so that the temperature of the cooler may be checked upon arrival at the laboratory.

4.3.1 Sample Containers

Samples for chemical analysis will be packaged, labeled, and placed in coolers with ice or equivalent coolant packs as soon as possible after collection. Samples for physical properties analysis will be sealed in airtight plastic jars for shipment to the laboratory.

All sample containers provided, with the exception of those for asbestos-containing material (ACM), will be new, pre-cleaned ICHEM Series 200 Eagle Picher, or equivalent, that are purchased with certificates of analysis. The types of containers that will be provided for each analyte are listed in Table 4-1.

All sample containers provided by the laboratory will be shipped with chain-of-custody records (see Subsection 7.1.4). These chain-of-custody records will be completed by field sampling personnel and returned with the samples.

4.3.2 Sample Preservation

Samples will be preserved as indicated in Table 4-1 or as otherwise specified in the site-specific QAPP checklist. Water samples designated for analysis of VOCs will be preserved at pH < 2 using reagent grade or better hydrochloric acid and stored at 4° ± 2° C until analyzed. Soil samples do not require the addition of preservatives (with the exception of soil samples for VOC analysis designated for Method 5035 SW846 analysis, unless an air-tight cartridge is used), but will be stored at 4° ± 2° C in an iced cooler between the time of sample collection and time of receipt at the laboratory.

Samples will be kept chilled from the time of collection until the time of analysis by the laboratory. Field personnel will keep samples cold using ice and coolers, in which samples are to be stored until delivery to the analytical laboratory. A temperature blank, which will be read by the laboratory upon receipt, will be placed into each cooler prior to shipment. After receipt of the samples, it is the laboratory's responsibility to store the samples at 4° ± 2° C until analysis is begun.

The preservatives required for all analyses will be provided by the laboratory with the sample containers. The required preservation methods for target analytes are listed in Table 4-1.

Table 4-1

Sample Volumes, Containers, and Analytical Methods
WKI Facility

Analysis	Minimum Sample Volume	Container	Preservative	Holding Times
SOIL/SEDIMENT/SOLIDS/CHIP				
VOCs	4 oz.	glass/air-tight sampler for SW846*	Cool, 4ºC±2ºC,solvents for SW846*	48 hours for extraction for SW846 Method 5035; 14 days
TCLP VOC	4 oz.	Glass	N/A	14 days leach/14 days analyze
WATER/LIQUIDS				
VOCs	40 mL (3)	Septum-capped glass	HCl to pH <2; Cool 4ºC ± 2ºC	14 days
AIR				
VOC*	N/A	Canister	None	14 days

* For samples designated for VOCs analysis by SW846, Method 5035 must be used for collection. This consists of a minimum of three custom air-tight cartridge samplers or weighing three aliquots of samples in the field in containers pre-filled with solvents as per Method 5035.

4.3.3 Holding Times

All samples, with the exception of those for ACM, have a finite holding time (the time between sample collection, sample extraction, and sample analysis) to limit the potential for degradation of the analytes. Freezing the samples to extend holding times is not acceptable.

Sampling holding times stated in Table 4-1 must be met unless otherwise specified in the analytical method. The holding times for the required analyses are measured from the verified time of sample collection. The samples will be shipped by overnight carrier or delivered by same-day carrier to minimize the time between collection and laboratory processing.

Upon sample receipt at the laboratory, all sample collection dates will be noted by the sample custodian. The required date for completion of analysis (or extraction) will be noted and keyed to the holding time. All analyses that have holding times of 48 hours or less will be identified by the sample custodian, and the appropriate laboratory manager and analyst will be notified that the samples are in the laboratory. The laboratory manager will be responsible for ensuring proper execution of all required analyses.

Advance notice that samples with a short hold time (48 hours or less) are being shipped will be provided by the field sampling team to the laboratory, so that the laboratory will have time to make necessary arrangements for analysis and instrumentation.

4.3.4 Sample Receipt

The analytical services laboratory will follow standard operating procedures (SOPs) for handling, identifying, control, and chain-of-custody procedures to maintain the validity of the samples. These SOPs are based on the use of a laboratory information management system (LIMS) for tracking samples from receipt through reporting of the analytical results.

Upon receipt, the sample custodian will inspect all sample containers for integrity. The presence of leaking or broken containers or custody seals will be noted on the chain-of-custody form. The

sample custodian will sign the chain-of-custody form (with date and time of receipt), thus assuming custody of the samples.

The information on the chain-of-custody form will be compared with that on the sample labels to verify sample identity. Any inconsistencies will be resolved with the project chemist before sample analysis proceeds.

4.4 SAMPLING EQUIPMENT DECONTAMINATION

Equipment decontamination is an integral part of the data collection and QA process. The implementation of proper decontamination practices and procedures will begin in the field prior to use of sample collection equipment. All field sampling equipment will be decontaminated before use and after each sample location, according to procedures outlined in the SAP. Wash water and other fluids generated during decontamination will be managed according to the requirements listed in the SAP and in accordance with WKI requirements.

5. SAMPLE CUSTODY PROCEDURES

5.1 DEFINITION

Custody is the physical possession of a sample and the storage of a sample in a secure area, and it is typically considered in three parts: sample collection, laboratory, and final (evidence) files. Laboratory raw data and other supporting records will be maintained by the laboratory a minimum of 5 years. Site-specific field logbooks will be maintained by WESTON for a minimum of 5 years.

5.2 CUSTODY PROCEDURES

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of all laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under a person's custody if:

- The item is in actual possession of the person.
- The item is in the view of the person after being in actual possession of the person.
- The item was in actual physical possession but is locked up to prevent tampering.
- The item is in a designated and identified secure area.

Sample possession during all sampling efforts must be traceable from the time of collection until the results are verified and reported. The sample custody procedures provide a mechanism for documentation of all information related to sample collection and handling to achieve this objective. The sample handling procedures are discussed in Subsection 4.3.4. This section contains a general discussion of sampling custody practices. The QC practices in this section are intended to address potential problems with labeling errors, transcription errors, preservation errors, etc. Overall, the QC checks discussed in this section are the mechanism that detects and corrects errors.

Sample custody procedures for this program are based on EPA-recommended protocols which emphasize careful documentation of sample collection and transfer data. These protocols are detailed in the *EPA Technical Enforcement Guidance Document (Section 4.4, OSWER-9950.1)*. The Technical Consultant Leader and field sampling team will be responsible for adherence to proper custody and documentation procedures for all sampling operations. To ensure that all of the important information pertaining to each sample is recorded, documentation procedures will be standardized.

Sample custody forms will be used to document the relevant information for each sample taken.

5.3 FIELD CUSTODY PROCEDURES

Each sample collected will immediately have a sample label attached to the sample container. Sample labels are given a unique field sample number and serve to identify the sample by documenting the sample type, who collected it, where it was collected, when it was collected, analysis required and the preservation method(s) used. These labels are completed with an indelible ink pen and are affixed securely to the sample container. The QA/QC samples (blanks and duplicates) will be numbered in the same manner and will not be distinguishable by the laboratory from normal samples.

Chain-of-custody records will be sequentially numbered to facilitate tracking of the shipment of individual samples. After the sample identification information is entered in the field logbook, it will be entered on the chain-of-custody form and shipped with the samples. The chain of custody form is then filed in document control.

Prior to shipping, a minimum of one custody seal will be affixed to each of the sample coolers sent off-site for sample analysis. The custody seals serve as a tampering indicator and must remain intact until the cooler is opened at the laboratory.

5.3.1 Field Records

Documentation of field sampling will be performed to ensure data validity and facilitate analysis and evaluation. Examples of field documentation are provided in the following subsections.

Field personnel are responsible for recording field activities on the appropriate field documentation form in sufficient detail to allow the significant aspects of the event to be reconstructed without relying on memory. It is the responsibility of the field sampling team to provide documents that are complete and legible. At the end of each day, documents completed that day will be reviewed for accuracy, completeness, and legibility.

The field documentation forms or equivalent records that will be used during this investigation are listed below:

- Soil sampling and borehole log forms.
- Field logbooks.
- Annotation of maps.
- Equipment calibration log.
- Sample chain-of-custody record (discussed in Subsection 5.3.4).

The specific documentation requirements are identified in the following subsections.

5.3.1.1 Soil Sampling and Borehole Log Forms

Certain descriptive and sample information will be recorded during the completion of each boring and the collection/logging of soil samples. The information will be recorded on a soil description form, borehole log form, or other appropriate form, as described in the appropriate SOPs.

5.3.1.2 Field Logbooks

After sample collection and before proceeding to the next sampling point, the samplers will complete the following procedures:

- Enter the sample into the chain-of-custody record per Subsection 5.3.4.
- Apply signed custody seals on the container lid.
- Complete appropriate forms or logbook entries.

A bound field logbook will be maintained by the field sampling team at the site to record information pertinent to daily activities, the field sampling program, and the equipment preparation efforts. Field logbooks will be bound, pages numbered, and entries made in permanent, waterproof ink. If an incorrect entry is made, the information will be crossed out with

a single strike mark, which is signed and dated by the sampler. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station, which includes compass and distance measurements, or, latitude and longitude information (e.g., obtained by using a global positioning system) shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration. The field sampling team will review field log entries daily. Field logbooks will be transferred to the project files at the end of field activities to provide a record of sampling.

The cover page of each logbook will contain the following:

- Person to whom the logbook is assigned.
- Project name.
- Project start date.
- End date.

A separate entry will be made for each sample collected. Field logbooks will contain the following type of information, where applicable:

- Name and location of site.
- Date(s) and time(s) of sample collection.
- Name of field team members.
- Field observations, including physical/environmental conditions during the field activity.
- Employee/visitor register.
- Training logs (site-specific, visitor).
- Summary of equipment preparation procedures.
- Number, type, location, depth, and analysis required of samples taken and sample identification codes.
- A description of sampling methodologies or references to the SAP/SOPs.
- A cross-reference to photographs, if photographs are taken.
- Sample container/preservative.

- A cross-reference of sample identification codes to site sampling points, composites, or grids that may be indicated on annotated site maps or sketches.
- Sample shipping dates and methods.
- Comments and other relevant observations such as sampling techniques and any modifications to sampling procedures, as well as other technical comments regarding color, odor, texture, and other sample characteristics.

Photographs may be taken of representative sampling locations and the surrounding site to show the area, sampling equipment, and related facility activities. Frame and roll numbers will be logged on the field documentation form, as appropriate, to identify photographs with the correct sampling location.

A separate logbook entry of information pertinent to health and safety may be maintained. Examples of this information include:

- Real-time personnel air monitoring results, when applicable.
- Heat stress/cold stress monitoring data, if applicable.
- Upgrades or downgrades of personal protective equipment (PPE). Reason(s) for upgrades or downgrades (documenting appropriate approvals) will also be provided.

5.3.1.3 Annotation of Maps

Copies of site base maps or sketches will be used by the field teams to record key site conditions and to show approximate locations of soil borings, buildings and structures, utilities, and other appropriate site location information. The maps or sketches will be maintained by the field sampling team.

5.3.1.4 Equipment Calibration Log

Equipment calibration logs will be maintained in the field logbook to record the calibration measurements and frequencies of site equipment.

5.3.1.5 Corrections to Documentation

Measurements made and samples collected will be recorded. Corrections will be made by drawing a line through the incorrect entry and writing in the correct entry. The person making the correction will date and initial the correction. There will be no erasures or deletions from the field logs.

5.3.2 Sample Labels

Each sample container will receive a sample label. Sample labels will identify the sample by documenting the unique sample identification number, the sample type, the analytical method, the sampler's initials, date collected, and the preservation method used. Sample labels are waterproof and will be completed with a permanent marker and affixed to the sample container.

5.3.3 Sample Identification

A unique sample code will be assigned to each sample collected; the sample code system is specified in the Data Management Plan (COPR, Vol 1). The field collection system will be set up to allow the field team leader or designated sampling coordinator to generate field sample identifiers prior to sample collection, if sufficient information is known (i.e., number of sampling locations and depths). Each unique identifier will be printed on the sample jar label, along with the date, time, and location from which the sample was taken.

Field Sample Identifiers will be generated so that there is no duplication. Each location at a facility will be given a unique, sequential number to ensure that the next sequential number will be used, even when returning to a site that has been sampled previously. Field Sample Identifiers for a given site will be stored in a temporary database until the samples are being prepared for shipment to the laboratory at the end of the sampling event. At that time, the chain of custody will be prepared by selecting the Field Sample Identifiers from the list, thereby providing a double-check that the Field Sample Identifier on the sample bottle is consistent with the chain of custody.

5.3.4 Chain-Of-Custody

An overriding consideration for environmental data is the ability to demonstrate that samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented to accomplish this goal. Documentation will be accomplished through a chain-of-custody record that records each sample and the individuals responsible for sample collection, shipment, and receipt.

All samples that are collected will be accompanied by a chain-of-custody record. The following information will be recorded to complete the chain-of-custody record:

- Project name and number.
- Initials of sampler.
- The sample number, location, date and time collected, and sample type.
- Analyses requested.
- Any special instructions and/or sample hazards.
- Signature of sampler in the designated blocks, indicating date, time, and company.
- The condition of the sample upon receipt as reported by the analytical laboratory.

The purpose of sample custody procedures is to document the history of sample containers and samples (and sample extracts or digestates) from the time of preparation of sample containers through sample collection, shipment, and analysis. An item is considered to be in one's custody if one or more of the following conditions apply:

- It is in a person's actual possession.
- It is in view after being in physical possession.
- It is locked up so that no one can tamper with it after having been in physical custody.

The following chain-of-custody procedures will be followed for all samples submitted to the laboratory for chemical or physical properties analysis:

- Each individual field sampler is responsible for the care and custody of samples they collect until the samples are properly transferred to temporary storage or for shipping.

- A chain-of-custody record will be completed by the sampler for all samples collected and submitted to the laboratory.

- Each time the samples are transferred, the signatures of the persons relinquishing and receiving the samples, as well as the date and time, will be documented.
- A copy of the carrier air bill will be retained as part of the permanent chain-of-custody documentation.
- The laboratory will record the condition of the sample containers upon receipt.
- The chain-of-custody form will be delivered by facsimile to WESTON from the laboratory upon receipt of the samples.
- Changes or corrections to the information documented by the chain-of-custody form (including, but not limited to, field sample ID or requested analyses) must be changed and initialed by the person requesting the change. In situations where the request comes from WESTON, a copy of the chain-of-custody form will be altered, initialed, and forwarded to the laboratory, where it will supersede the original chain-of-custody form.
- A copy of the chain-of-custody form and any documented changes to the original will be returned from the laboratory as part of the final analytical report to the Technical Consultant Leader. This record will be used to document sample custody transfer from the sampler to the laboratory and will become a permanent part of the project file.

5.3.5 Shipping Procedures

The objective of sample handling procedures is to ensure that samples arrive at the laboratory intact, at the proper temperature, and free of external contamination. Samples will be packed and shipped in accordance with applicable U.S. Department of Transportation (DOT) regulations, consulting corporate guidelines, and International Air Transport Association (IATA) standards (as detailed in the most current edition of *IATA Dangerous Goods Regulations* for hazardous materials shipments), as applicable.

5.4 LABORATORY OPERATIONS

The analytical services laboratory will follow their standard operating procedures (SOPs) for handling, identification, control, and chain-of-custody procedures and to maintain the validity of the samples. These SOPs are based on the use of a laboratory information management system (LIMS) for tracking samples from receipt through reporting of the analytical results.

5.4.1 Sample Receipt

A designated sample custodian will be responsible for samples received at the laboratory. The sample custodian will be familiar with custody requirements and the potential hazards of dealing with environmental samples. In addition to receiving samples, the sample custodian will also be responsible for documenting sample receipt, storage before and after sample analysis, and the proper disposal of samples. Upon sample receipt, the sample custodian will:

- Inspect the sample container for integrity and ensure that custody seals are in place. The sample cooler temperatures will be taken and documented and the presence of leaking or broken containers will be noted on the chain-of-custody/sample analysis request forms.
- Sign (with date and time of receipt) the chain-of-custody/sample analysis request forms, thus assuming custody of the samples, and assign the laboratory sample identification numbers.
- Compare the information of the chain-of-custody/sample analysis request forms with the sample tags and labels to verify sample identity. Any inconsistencies will be resolved with a field sampling representative before sample analysis proceeds.
- Store samples in accordance with Subsection 5.4.2.
- Alert appropriate laboratory managers and analysts of any analysis requiring immediate attention because of short holding times specified in analytical protocols.

5.4.2 Sample Storage

Analytical samples will be maintained in a locked refrigerator maintained at 4° ± 2° C. The temperature will be monitored by the laboratory security system and recorded daily according to the laboratory SOP by the sample custodian or QA/QC auditor. Provisions will be in place to handle emergency conditions. The laboratory will maintain controlled building access. All samples will require chain-of-custody sign-out. These procedures will be documented in laboratory SOPs.

5.4.3 Sample Tracking

Each sample will receive a unique laboratory sample identification number at the laboratory when it is logged into the laboratory computer. Each person handling a sample batch will note the location change, time, and date, and will sign the custody record.

For samples that require extraction or digestion prior to analysis, a sample extraction or digestion record will be prepared. Laboratory data will be entered on the sample extraction form by computer and permanently recorded in a bound laboratory logbook.

The laboratory will maintain a sample tracking system that documents the following activities:

- Organization/individual who performed sample analyses.
- Date of sample receipt, extraction, if applicable, and analysis.
- Sample holding times.
- Names of all analysts.
- Sample preparation procedures.
- Analytical methods used to analyze the samples.
- Calibration and maintenance of instruments.
- Deviations from established analytical procedures, if applicable.
- QC procedures used to ensure that all analyses were in control while data were being generated (instrument calibration, precision checks, method standards, method blanks, etc.).
- Procedures used for the calculation of precision and accuracy for the reported data.
- Statement of quality of analytical results.

5.4.4 Recordkeeping

Data related to sample preparation and analysis, as well as observations by laboratory analysts, will be permanently recorded in bound laboratory notebooks. Laboratory notebook pages will be signed and dated daily by laboratory analysts. Corrections to notebook entries will be made by

drawing a single line through the erroneous entry and writing the correct entry next to the one crossed out. Corrections will be initiated and dated by the analyst.

5.5 FINAL EVIDENCE FILES

The final evidence file will be the central repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. WESTON is the custodian of the evidence file and maintains the contents of evidence files for the investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited access area and under custody of the WESTON facility manager.

The final evidence file will include at a minimum:

- Field logbooks.
- Field data and data deliverables.
- Photographs.
- Drawings.
- Soil boring logs.
- Laboratory data deliverables.
- Data validation reports.
- Data assessment reports.
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation (tags, forms, air bills, etc.).

6. CALIBRATION PROCEDURES AND FREQUENCY

6.1 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

6.2 FIELD INSTRUMENT CALIBRATION

This section contains brief descriptions of the analytical methods and calibration procedures for the field measurements collected during the remediation activities. Calibration procedures for field instrumentation are performed to provide instruments that are operating properly and produce data that can satisfy the objectives of the sampling program. Several types of real-time instruments are used to monitor and evaluate the physical parameters of water and soil. These screening level data are used to monitor worker health and safety and to assist sample collection. Field instruments used for this program may include:

- Instruments for measuring ground-water parameters:
  - pH meter
  - Conductivity meter
  - Thermometer or temperature sensor on a Hydrolab® probe.
- Real-time organic vapor monitoring instruments:
  - Photoionization detectors (PIDs), such as HNU®, organic vapor monitor (OVM), and Micro TIP®
  - Flame ionization detectors (FIDs) or organic vapor analyzer (OVA).
- Aerosol monitor.
- Combustible gas meter.

To provide the instruments that are operating properly and are producing accurate and reliable data, routine calibration will be performed prior to and during use. Factory calibrations should be performed at a frequency recommended by the manufacturer. Calibration procedures are normally

included with the equipment. Field calibrations should be performed at the beginning of the day and at the end of the day. Calibrations should be checked throughout the sampling day. If field calibration reveals that the instrument is outside established accuracy limits, the instrument should be serviced in the field according to manufacturer's specifications. If necessary, return the instrument to the manufacturer for immediate repair and servicing. A backup instrument should be available for each of the critical real-time instruments used in the field. Calibration records will contain the following information, as appropriate:

- Instrument name and identification number.
- Name of person performing the calibration.
- Date of calibration.
- Calibration points.
- Results of the calibration.
- Manufacturer's lot number of the calibration standards.
- Expiration dates for the field standards, where applicable.

Field equipment will be properly inspected, charged, and in good working condition prior to the beginning of each working day. Prior to the start of each working day, the field sampling team will inspect the equipment to ensure its proper working condition. Field equipment and instruments will be properly protected against inclement weather conditions during the field investigation. At the end of each working day, all field equipment and instruments will be properly decontaminated, taken out of the field, and placed in a cool, dry room for overnight storage and charging.

6.2.1 Water Sampling Instrument Calibration

Field pH, conductivity, and turbidity meters, as well as thermometers are used to measure water parameters when collecting groundwater. The meters are calibrated prior to purging well water. The pH, conductivity, and turbidity meters are calibrated with at least two standard calibration solutions that bracket the expected range of measurements. The calibration solutions are supplied by the manufacturer or are commercially available.

pH Meter

Sample pH will be measured on-site according to the requirements of SW9040A. A pH sensor with the Hydrolab probe will be used for determining pH (to ± 0.1 pH unit) in groundwater and for other water quality applications. This instrument will be calibrated according to the manufacturer's specifications daily with a two-point calibration prior to sample analysis. If the drift exceeds 0.2 pH units, a new multipoint calibration will be performed.

Specific Conductance

Specific conductance will be measured on-site according to the requirements of SW9050. A specific conductance sensor on the Hydrolab probe can be used to measure specific conductance of the groundwater. The instrument will be calibrated before analysis of the field samples, using KCl solutions of known conductance. The calibration is checked at a frequency of 5% (at least once a day) with a single-point calibration standard. If the response varies less than ±10% of the calibration check sample, calibration of the instrument is considered valid and any meter drift insignificant. A correction for any temperature deviation from 25° C can be made using recorded field temperature.

Temperature

Temperature will be measured according to the requirements of EPA Method 170.1. On-site water temperature can be measured using a temperature sensor Hydrolab® probe. This sensor will be checked against a National Institute of Standards and Technology (NIST) reference thermometer. Temperature readings will be measured to the nearest °C or °F.

Turbidity Meter

Turbidity (when needed) will be measured according to the requirements of EPA Method 180.1. Turbidity will be measured using the turbidity meter on the Hydrolab probe. A standard suspension of Formazin with turbidity within the expected range of sample turbidities will be used to calibrate the instrument daily to check the instrument's precalibrated scale. The

instrument range is 0.1 to 200 nephelometric turbidity units (NTUs). The instrument will be calibrated daily with a 4.0 NTU standard. A new stock standard should be prepared monthly.

6.2.2 Real-Time Organic Vapor Monitoring Instrument Calibration

Real-time organic vapor meters (OVMs) are routinely used to monitor total airborne organic vapors during field operations; measurements are used to evaluate worker health and safety. PPE requirements and site control decisions are based on the results of real-time measurements. Real-time instruments also provide screening level data for VOC concentrations in drill cuttings, soil boring samples, and groundwater wells. Several types of OVMs are available. Generally, these instruments utilize one of two primary detection methods for quantifying total airborne VOCs: a flame ionization detector (FID) or a photoionization detector (PID). Calibration frequencies for each commonly used instrument are presented in the following subsections. Due to the rigors of field use, backup instruments should always be available. Detailed procedures for calibration and operation of these instruments are available from the distributors.

6.2.3 Flame Ionization Detector (FID)

FIDs can measure total concentrations of hydrocarbon vapors. The instruments are generally calibrated using methane in air, and the instrument response for each specific compound is proportional to its response factor relative to methane.

The Century Systems Foxboro organic vapor analyzer (OVA) (Models 88, 108, and 128) is the most commonly used FID field instrument. The recommended calibrations for field OVAs are:

- Factory calibration and service once per year.
- Five-point calibration using four methane-in-air standards and ultra-high purity (UHP) air performed once each quarter.
- Three-point calibration using two methane-in-air standards and UHP air prior to daily use.
- Single-point calibration check using a representative methane-in-air standard after every 4 hours of operation and at the end of each working day.

6.2.4 Photoionization Detector (PID)

PIDs can measure total organic vapors and are highly sensitive to aromatic compounds, moderately sensitive to unsaturated chlorinated compounds, and less sensitive to aliphatic hydrocarbons. The instrument can respond to organic compounds with ionization potentials (IPs) less than the rated electron voltage (eV) of the ultraviolet (UV) bulb in the unit. Due to its longevity and range of detectable contaminants, the most frequently used UV bulb is a 10.2 eV. Other bulbs are available from the manufacturer (e.g., 9.5 eV, and 11.7 eV). Field personnel must know which bulb is installed in the unit to ensure that the instrument is capable of detecting the particular contaminant of interest.

Several manufacturers produce instruments with PIDs for field monitoring of airborne VOCs. The more common PIDs are HNU® Systems (PI-101), Thermo Environmental OVM (580 B), and Photovac MicroTIP® (Total Ionizables Present). Follow the manufacturer's calibration requirements. General guidance for PID calibration includes:

- Factory service and calibration once per year.
- The HNU Systems PI-101 requires a three-point calibration on a quarterly basis using UHP air and two representative concentrations of isobutylene-in-air standards.
- For any PID instrument, a two-point calibration prior to daily use (UHP air and a representative concentration of isobutylene in air standard).
- Single-point calibration at the end of each day of use.

6.2.5 Aerosol monitor

Aerosol monitors measure the amount of dust particles in the air. The instruments are generally calibrated by the factory against a gravimetric reference using a standard dust test. The instrument should be recalibrated by the manufacturer or authorized service facility every 12 months. The MIE Miniram is the most commonly used aerosol meter

6.2.6 Combustible gas meter

Combustible gas meters measure the percent oxygen in the air and also evaluate the combustible gas level. The instruments are generally calibrated using pentane and oxygen.

The MSA Model 260 and Gastec Model 1314 are the most commonly used combustible gas/oxygen meters. Follow the manufacturer's calibration requirements. General guidance for PID calibration includes:

- Single-point calibration check using a pentane or hexane in air and oxygen in air each day.

6.3 LABORATORY ANALYTICAL AND CALIBRATION PROCEDURES

The objective of the analytical effort is to provide sufficient information to determine presence or absence of chemical contamination. Presence or absence of chemical contamination will be determined by detection, or non-detection, of target analytes in environmental samples. Results of chemical measurement analyses will be compared to the sampling and analysis criteria to determine if DQOs have been met. One objective for the chemical measurement data is to use standard methods and controlled systems to collect and analyze samples.

The performing laboratories will provide documented procedures and laboratory QA program information to verify that the laboratory has appropriate experience and expertise to perform the analyses.

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and continuing calibration verification. For a description of the calibration procedures for a specific laboratory instrument, refer to Section 6 of the applicable SOPs in Appendix A of this QAPP. The SOP for each analysis performed in the laboratory describes the calibration procedures, their frequency, acceptance criteria and the conditions that will require recalibration. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution.

The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration , analyst, calibration solutions run and the samples associated with these calibrations.

7. ANALYTICAL PROCEDURES

7.1 ANALYTICAL PROCEDURES

Groundwater and soil VOC samples collected during the field sampling activities for the WKI facility remediation effort will be analyzed by:

STL Chicago
2417 Bond Street
University Park, IL 60466
Tel: 708-534-5200
Fax: 708-534-5211

Routine analytical services are performed using standard EPA- and Contract Laboratory Program (CLP)- approved methodology. Where possible and most practicable, SW846 methods will be used. However, CLP and SW846 methods are discussed in this QAPP. Analytical methods cited in this QAPP reference:

- *The Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA SW846), Third Edition, Revision 0, November 1986 and January 1995 and December 1997 updates.
- *Methods for Chemical Analysis of Water and Wastes*, (U.S. EPA, 1983), EPA CLP Statement of Work for Organics and Inorganics.
- American Society for Testing and Materials (ASTM).

Analytical methods selected and the reporting limits are presented in Table 7-1. Specific methods for a particular task must be specified in the SAP. In some cases, modification of standard methods may be necessary to provide accurate analysis of particularly complex matrices (e.g., tissue analysis). When modification to standard analytical methods are performed, the specific alterations, as well as the justification for the change, will be presented in the case narrative accompanying the analytical report. The choice of method will be determined by the type of sample and the project requirements.

The laboratory will perform a soil moisture test in accordance with EPA SW846 procedures for determining dry sample weight on each soil sample, except for those designated for ACM

Table 7-1

Analytical Methods and Reporting Limits
WKI, Massillon, Ohio, Facility Contaminants of Concern

Site-Specific Volatile Parameters	SW 846 Reporting Limits	
	Water (µg/L)	Soil[a] (µg/kg)
Vinyl chloride	1	5/500
1,1-Dichloroethene	1	5/500
1,1-Dichloroethane	1	5/500
1,2-Dichloroethene (total)	1	5/500
1,1,1-Trichloroethane	1	5/500
Trichloroethene	1	5/500

[a] Method 5035 Low/High extraction.

SW 846 = Test Methods for Evaluating Solid Waste, Third Edition (Update III), December 1997.

Note: Reporting limits will vary based on sample volume/size, dry weight reporting (soils) and annual Method Detection Limit determinations.

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analysis, so that the analytical data will be reported on a dry weight basis. Alternatively, if requested, the laboratory will perform soil moisture tests in accordance with ASTM D2216-71 *Laboratory Determination of Moisture Content of Soil*.

7.1.1 Common Laboratory Contaminants

Certain Target Compound List (TCL) VOCs such as methylene chloride, acetone, 2-butanone, and toluene are commonly detected as laboratory contaminants. To ensure that the data reported are not biased by potential laboratory contamination, certain QA procedures, including reagent blank analysis, will be followed. Assessment of the reagent blanks will follow the procedures specified by U.S. EPA *Region Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, (April 1993) and *National Functional Guidelines for Organic Data Review* (September 1994).

For the analysis of volatile TCL compounds, a method blank analysis will be performed once per lot, or with every 20 samples of similar concentrations of target compounds. Blanks must contain less than 10 times the EPA Contract Required Reporting Limit (CRRL) of methylene chloride, acetone, and 2-butanone, or 5 times the CRRL for other organic compounds (such as toluene) for the reported data to be considered valid.

It is understood that the site may be composed of some chemical matrices that may cause interferences with organic analyses; therefore, sample cleanup protocols may be implemented to the extent possible to eliminate interferences that reduce the sensitivity of the analyses. The primary cleanup steps that are expected to be employed, when interferences are present, will be Florisil cleanup SW846 Method 3620 in conjunction with analytical Methods 8081/8082 and Gel Permeation cleanup SW846 Method 3640 in conjunction with analytical Methods 8151 and 8270. Other equivalent methods may be proposed by the laboratory.

7.2 FIELD SCREENING FOR VOLATILE ORGANIC CONSTITUENTS

Field screening for volatile organic vapors during sampling may be conducted primarily for two reasons:

- To evaluate ambient air quality as part of health and safety monitoring.

- To preliminary evaluate volatile organic content in soil samples so that the soil most likely to be contaminated may be preferentially selected for chemical analysis.

Instruments to be used for field screening during intrusive activities may be an OVA, PID, aerosol monitor, oxygen meter, or combustible gas indicator. Because the instruments are to be used for screening purposes only, there are no specific DQOs. Daily calibration of these instruments according to the manufacturers' specifications will provide for sufficient accuracy in evaluating the potential health risks and for selecting soil samples for laboratory analysis.

7.2.1 Health and Safety Evaluation

As required by the Health and Safety Plan (HASP), an OVA, PID, or other field instruments may be used to measure the total volatile organics (or other constituents) in the breathing zone as the field team engages in intrusive activities, such as test pit excavation and sampling, well installation, soil sampling, and groundwater sampling.

If such monitoring is performed, a background measurement will be made prior to beginning the activity each day. During intrusive activities, the area will be periodically or continuously monitored.

Measurements of total organic vapor will be recorded in the field notebook relative to the background reading. All site personnel will be aware of action levels that indicate the type of PPE to be worn by participating personnel.

7.3 METHOD DETECTION AND QUANTITATION LIMITS

This section presents and defines limits to be used in describing detectable concentrations.

7.3.1 Terminology

The method detection limit (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 quantitation limit is defined as the reporting limits. Blank concentrations should be below the quantitation limit or corrective action should be taken. Corrective action is not necessary if the concentration in the field samples is greater than 10 times the blank

concentration. Reporting limits for the analytical methods are presented in Table 7-1. In some cases, lower quantitation limits may be necessary to evaluate data versus project cleanup criteria or action levels. Individual sample reporting limits may vary from the laboratory's routinely reported reporting limits. This may be a result of dilution requirements, variability in sample weight or volume used to perform the analysis, dry weight adjustment for solid samples, the presence of analytical background contaminants, or other sample- or analysis-related conditions.

7.3.2 Procedures

The performing laboratory will perform MDL studies on an annual or quarterly basis (depending on the method) to demonstrate that it can meet or exceed the method recommended MDLs or quantitation limits. The U.S. EPA procedure used for establishing MDLs is described in Appendix B to Part 136 "Definition and Procedure for the Determination of the Method Detection Limit" - Revision 1.11, 40 CFR 136, 1986. This procedure consists of analyzing (using all sample processing steps specified in the method) seven aliquots of a standard spiked at three to five times the expected MDL. The MDL is defined as three times the standard deviation of the mean value for the seven analyses. In addition, the laboratory may establish reporting limits which are verified by the MDL studies and included on the laboratory's analytical reports.

7.4 LABORATORY EQUIPMENT CALIBRATION

This subsection provides the requirements for calibration of measuring and test equipment and instruments used in laboratory analysis. This program is designed to ensure that all instrumentation are calibrated to operate within manufacturers' specifications and that the required traceability, sensitivity, and precision of the equipment/instruments are maintained. Measurements that affect the quality of an item or activity will be taken only with instruments, tools, gauges, or other measuring devices that are accurate, controlled, calibrated, adjusted, and maintained at predetermined intervals to ensure the specified level of precision and accuracy.

Before any instrument is used as a measuring device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements are

made within the calibrated range of the instrument. Preparation of all reference materials used for calibration will be documented in a laboratory notebook.

Laboratory instrument calibration typically consists of two types: initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is expressed as a correlation coefficient.

Continuing calibration usually includes measurement of the instrument response to fewer calibration standards and requires instrument response to compare certain limits (e.g., 10%) of the initial measured instrument response. Continuing calibration may be used within an analytical sequence to verify stable calibration throughout the sequence and/or to demonstrate that instrument response did not drift during a period of nonuse of the instrument.

Calibration procedures for the following instruments are provided in the ensuing subsections:

- Gas chromatograph (GC).
- Gas chromatograph/mass spectrometer (GC/MS).
- Atomic absorption (AA) spectrophotometer.
- Inductively coupled plasma (ICP) spectrometer.
- TOC analyzer
- Balances
- Thermometers

Instrument calibration procedures for various instruments used in the laboratory (which are not in this QAPP) will be provided in the individual laboratory's QAPP.

7.4.1 Gas Chromatograph (GC) Calibration

The initial calibration for the GC will include analysis of a 5-point calibration for each analyte of interest. One of the standards should be at or below the reporting limit, while the other concentrations should define the working range of the detector. The percent relative standard deviation (RSD) must be <20% prior to analyzing any samples.

Mid-level standards are analyzed after every 10 injections for continuing calibrations. Continuing calibration standards must fall within the specific acceptance criteria of their respective method.

Calibration data including the correlation coefficient will be entered into laboratory notebooks and the laboratory information management system to maintain a permanent record of instrument calibrations.

7.4.1.1 GC Quality Control

At least one method blank and two method spikes will be included in each laboratory lot of samples, representing a minimum of 5% of QC. Lot sizes vary depending on the volume of sample submitted for analysis. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately three to five times the reporting limits.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. These recoveries will be plotted on control charts to monitor method accuracy. Precision for U.S. EPA methods will be measured by the reproducibility of both method spikes and will be calculated as relative percent difference (RPD). These percent RPDs will be plotted on control charts to monitor method precision.

7.4.1.2 GC/MS Instrument Calibration

Mass spectrometers (MSs) are calibrated with perfluorotributylamine (FC-43), as required, to ensure correct mass assignment. In addition, once per shift, these instruments will be tuned with decafluorotriphenylphosphine (DFTPP) or 4-bromo-fluorobenzene (BFB) for SVOCs or VOCs, respectively. Ion abundances will be within the windows dictated by the specific program requirements. Once an instrument has been tuned, initial calibration curves for analytes (appropriate to the analyses to be performed) are generated for at least five solutions containing

known concentrations of authentic standards of compounds of concern. The calibration curve will bracket the anticipated working range of analyses.

Calibration data that include linearity verification determined by response factor evaluation will be maintained in the laboratory's permanent records of instrument calibrations.

With regard to Method 8260, the following notes apply:

- TCL Compounds that typically exhibit poor response factors or sensitivities for Method 8260 are 2-hexanone and 2-butanone. This should be taken into consideration for data usability.

7.4.2 Atomic Absorption (AA) Calibration

AA spectrophotometers will be calibrated prior to each day of use.

Calibration standards will be prepared from appropriate reference materials, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of three concentrations to cover the anticipated range of measurement.

Duplicate injections will be made for each concentration. At least one of the calibration standards will be at or below the desired instrument reporting limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.995 in order to consider the responses linear over a range. If a correlation coefficient of 0.995 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, including the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

7.4.3 Inductively Coupled Plasma (ICP) Calibration

7.4.3.1 Initial Calibration

The instrument is profiled according to manufacturer's specifications. One blank and three standards are analyzed to calibrate the instrument. Each element analyzed consists of three burns

and the results are reported in intensity units. After the initial calibration, an initial calibration verification, (ICV) prepared from a source other than the calibration standard, is analyzed. The ICV concentration is at the midpoint of the calibration curve and must be within the control limits 90-110%. Following the ICV, an initial calibration blank (ICB) is analyzed. The result of the ICB analysis must be less than the reporting limit.

7.4.3.2 Continuing Calibration

A continuing calibration verification (CCV) is analyzed after every 10 readings and at the end of an analytical batch to confirm that the calibration has not drifted. The CCV concentration, prepared from a source other than the calibration standard, is at the midpoint of the calibration curve for each element. The results of the analysis must be within the control limits of 90-110%.

After the CCV, a continuing calibration blank (CCB) is analyzed. The results of the analysis of the CCB must be less than the reporting limit.

7.4.4 TOC Analyzer Calibration

The Dohrman TOC analyzer is calibrated with a standard reference material using a single-point calibration. The calibration standard is analyzed before beginning every analytical run. The linearity of the calibration is verified with a low-level and high-level standard to bracket the sample concentration. The linearity checks must be within 5%. The continuing calibration verification standard (using mid- and high-level standard) is analyzed every 10 samples and at the end of the run, and the response must be with ± 15%.

7.4.5 Balances

Laboratory balances will be calibrated and serviced annually by a factory representative. In addition, the analyst will check the balance before each day's use with two masses: one in the gram range and one in the milligram range, or before each use with a mass closest to the range of weighings being done. A record of calibrations and daily checks will be kept in the balance log.

The Class P weights used for balance checks will be used to detect drift or a change in balance operation. Calibration of the balances is verified weekly against three NIST-traceable Class S-

certified weights in the approximate range of the balance. The NIST weights will verify the accuracy of the balance between the lowest and highest weights used during the verification process. The Class S weights used by the analysts for daily balance checks will be calibrated annually by a certified agency.

7.4.6 Thermometers

Oven and refrigerator thermometers will be calibrated annually against a NIST-certified thermometer in the range of interest. Annual calibrations will be recorded in a calibration notebook. Daily readings will be recorded from the respective oven or refrigerator.

7.4.7 Records

Records will be maintained as evidence of required calibration frequencies, and equipment will be marked suitably to indicate calibration status. If marking on the equipment is not possible, records traceable to the equipment will be readily available for reference.

8. QUALITY CONTROL REQUIREMENTS

The daily quality of analytical data is controlled by the implementation of a laboratory-specific QA/QC Plan. A QC program is a systematic process that controls the validity of analytical results by measuring the accuracy and precision of each method and matrix, developing expected control limits, using these limits to detect errors or out-of-control events, and requiring corrective action techniques to prevent or minimize the recurrence of these events.

This section defines common QC checks and the QC checks specified in Table 3-1. The inclusion of a definition in this section does not necessarily mean the QC check is required for this sampling event. The required QC checks, the frequency for the checks, and the acceptance criteria for the checks are listed in Section 4. The purpose of preparing and analyzing QC samples is to demonstrate, through the known entities, how accurate and precise the investigative sample data are. The types of internal QC checks are described in the following subsections; for high resolution and complicated analytical protocols, more rigorous QC checks and cleanup procedures will be performed. In addition, the DQI designation is indicated for each of these QC analyses. See Section 15 for overall description of the data quality indicators: accuracy/bias, precision, representativeness, completeness, comparability, sensitivity, and selectivity.

8.1 ANALYTICAL QUALITY CONTROL REQUIREMENTS

8.1.1 Method Blank

The method blank is an artificial sample designed to monitor artifacts that may be introduced into the sample during sample preparation or analysis. For analyses of aqueous samples, reagent water is generally used as the method blank matrix. For analyses other than radiological analyses of solid samples, a purified solid matrix is used. The method blank is carried through the entire analytical scheme (extraction, concentration, and analysis). For metals analyses, the method blank is referred to as the preparation blank. The volume or weight of the blank must be approximately equal to the sample volume or weight processed. A method blank is performed with each batch of samples or one with every 20 field samples, whichever is more frequent. Analysis of the blank verifies that method interferences caused by contaminants in solvents,

reagents, glassware, and other sample processing hardware are known and minimized. Optimally, a method blank should contain no greater than five times (5x) the practical quantitation limit for common laboratory solvents and phthalate esters; less than one-half the practical quantitation limit (PQL) for all other parameters, unless otherwise specified in the method or QAPP. DQI–Accuracy/Bias-Contamination.

8.1.2 Trip Blank

The trip blank is an artificial sample designed to monitor volatile artifacts that may be introduced into the sample during sample transportation. Reagent water is generally used as the trip blank matrix. The trip blank is treated as field sample and is carried through the analytical scheme. A trip blank should accompany every cooler containing field samples for volatile organic analysis. DQI–Accuracy/Bias-Contamination.

8.1.3 Equipment/Rinsate Blank

The equipment blank is an artificial sample designed to monitor artifacts that may be introduced into the sample during sample collection. Reagent water is generally used as the equipment blank matrix and the equipment blank can be analyzed for all required parameters. (Hexane blanks may be collected, in lieu of aqueous equipment blanks, for PCB analysis at the on-site laboratory facility.) The equipment blank is treated as field sample and is carried through the analytical scheme. At least one equipment blank per sampling event will be collected during the sample equipment decontamination procedure and submitted with the associated samples for analyses. DQI–Accuracy/Bias-Contamination.

8.1.4 Sulfur/Sulfuric Acid/GPC Cleanup Blanks

When sample extracts for pesticide/PCB analyses require a sulfur cleanup, sulfuric acid cleanup, and/or gel permeation chromatography (GPC) cleanup, associated blanks are performed. These method blanks monitor for contamination from the various cleanup steps. DQI–Accuracy/Bias-Contamination.

8.1.5 Matrix Spike

Predetermined quantities of specific analytes are added to a sample matrix prior to sample extraction or digestion. Percent recoveries are calculated for each analyte to assess the accuracy of the analyses. Matrix spikes monitor the effects of the sample matrix on the analytical results, as well as assess the accuracy of the analytical method. One matrix spike for every 20 samples collected will be performed for all applicable methods. The field samples to be spiked will be selected by field personnel and will not include field blank samples (trip blanks and equipment blanks). This will ensure that a sample matrix with possible analyte detections will be spiked to obtain representative results of analytical accuracy. DQI– Accuracy/Bias (LAB).

8.1.6 Matrix Spike Duplicate

Primary and duplicate matrix spikes will be performed on the same field sample. The matrix spike duplicate will assess the analytical and sampling precision by calculating a relative percent difference between the primary and duplicate spike recoveries. If poor precision is demonstrated between sets of results, it is probably an indication of laboratory performance problems. DQI-Precision (LAB).

8.1.7 Surrogate Spike

Surrogate compounds are organic compounds that are similar to analytes of interest in terms of their chemical composition and extraction and chromatographic properties, but that are not normally found in environmental samples. These compounds are spiked into all field and laboratory quality control samples (blanks, standards, and matrix spikes) for VOC, SVOC, PCDD/PCDFs, herbicides, and pesticide/PCB analyses. (Refer to SW-846 Methods 8260B, 8270C, 8082, 8081A, 8141A, 8150B, and 8290.) Percent recoveries are calculated for each surrogate compound in each sample. These recoveries give an indication of the performance and estimate accuracy of the analytical method by incorporating sample matrix effects and field conditions. DQI-Accuracy/Bias.

8.1.8 Replicate Sample (Laboratory Duplicate)

To assess the precision of the analytical method for given analyses, a replicate sample is analyzed by taking aliquots from a sample container, and an RPD is calculated for the results of the analyses of the primary sample and the replicate sample from the same container. Such replicate samples will be analyzed for metals. A replicate sample measures sample precision associated with the preparation through analysis and is prepared and analyzed at a rate of one per batch or one per 20 samples (if a batch is less than 20 samples). Field personnel will select the metals sample to be analyzed as a replicate. DQI-Precision (LAB).

8.1.9 Instrument Performance Check (Tuning)

GC/MS analyses require that the mass spectrometer be tuned prior to calibration and sample analysis. (Refer to SW846 Methods 8260B, 8270C, 8290, and Modified EPA Method 1668.) This is accomplished with analysis of a compound with properties similar to analytes of interest but that is not commonly found in the environment. For tunings and mass calibration, BFB and decafluorotriphenyl/phosphine (DFTPP) will be used for VOC and SVOC GC/MS analyses, respectively; refer to SOPs A-36, A-38, A-47, A-51, and A-52 for PCDD/PCDF and PCB congener/homolog analyses. Specific ion abundance criteria must be met, as defined in the appropriate method, before analyses begin. DQI-Accuracy/Bias.

8.1.10 Initial Calibration

An instrument is calibrated initially with a series of standards at predetermined concentrations to identify the response factor of the instrument over the given concentration range. (Refer to SW-846 Organic Methods 8260B, 8270C, 8081A, 8082, 8141A, 8150B, and 8290.) This calibration is performed for most instruments when there has been a change in instrument conditions or when the continuing calibration check result is outside a defined acceptance criterion. DQI-Precision.

8.1.11 Calibration Check (Calibration Verification)

The initial instrument calibration is verified at regular intervals, for all SW-846 organic analyses, to account for potential instrument drift or other changes in instrument conditions. A standard with a concentration within the calibration range is analyzed after every 10 sample analyses or at a frequency defined in the analytical method. The standard result is compared to the initial calibration, and a percent difference or RPD is calculated. If the result is not within the established acceptance criterion range, then the analytical system is evaluated and recalibrated before resumption of sample analyses. DQI-Precision.

8.1.12 Retention Time Window (RTW)

Retention times of target analytes for GC and GC/MS analyses must be monitored for shifts during sample analyses. The allowed shift of retention time for a given analyte is called the retention time window. Retention time windows are established according to the analytical method. The retention time windows should be collected for three standards run over the course of 72 hours. Acceptance criteria are expressed as an established range, or, for pesticides analyses, as plus or minus three times the standard deviation of three retention times of the same analyte. Shifts that occur outside the acceptance criteria indicate a change in the chromatographic system or an instrument problem, and could lead to misidentifications unless corrective action is taken. DQI-Accuracy/Bias

8.1.13 Internal Standards

Internal standards and/or isotopically labeled standards are performed for volatile, semivolatile, PCB congener, and/or dioxin/furan analyses and are used to ensure that system sensitivity and response are stable throughout all analyses. It corrects for bias or change in instrument performance from sample to sample, incorporating effects associated with the analytical process only. Internal standards are compounds similar in analytical behavior to the analytes that are added to the calibration standards. Response factors of these standards are used to quantitate sample results. Criteria for internal standard responses and retention times are defined in the analytical methods. DQI-Sensitivity, Accuracy/Bias.

8.1.14 Initial and Continuing Calibration Blanks (ICB, CCB)

A blank consisting of reagent water is analyzed immediately after every initial and continuing calibration verification for metal analyses, and after completing every 10% of the sample analyses to be performed for each batch of samples, or after every 2 hours, whichever is more frequent. (Refer to SW-846 Methods 6010B, 7470, and 7471A.) DQI-Accuracy/Bias-Contamination.

8.1.15 Laboratory Control Sample

An LCS is a standard solution of a certified concentration prepared by a source external to the laboratory performing the analysis that is used to measure analytical accuracy. This QC check is performed for metals, volatiles, semivolatiles, PCDD/PCDFs, pesticides/PCBs, herbicides, and total dissolved and suspended solids analyses for every batch of analytical samples. The recovery of the LCS analysis for metals must be within 80 to 120%. Acceptance criteria for the other LCS analyses are outlined in Table 3-1. LCS provides evidence that the laboratory is performing the method within accepted guidelines, generally in the absence of matrix interferences. They are prepared at a rate of one per batch of 20 or fewer samples. DQI-Sensitivity.

8.1.16 Initial Calibration Verification (ICV)

After the ICP, atomic absorption (AA), and cyanide systems are calibrated, the accuracies of their initial calibrations are verified with analyses of calibration verification standards. (Refer to SW-846 Methods 6010B, 9010B, 7470, and 7471A.) Control limits have been established for each system (ICP and AA: 90 to 110% of the true value; AA-cold vapor for mercury: 80 to 120% of true value; and cyanide: 85 to 115% of true value). If a control limit is exceeded, then the problem causing this deviation must be identified and corrected, and the instrument recalibrated.

In addition, SW-846 Organic Methods 8260B, 8270C, 8081A, 8082, 8141A, and 8150B have an initial calibration verification performed daily prior to sample analysis. It is usually a midpoint and low-level standard purchased from a second source vendor used to verify the accuracy curve for all target analytes. (Refer to the SW-846 method for specific protocol.) DQI-Accuracy/Bias.

8.1.17 Continuing Calibration Verification (CCV)

The initial calibrations of ICP, AA, and cyanide systems must be verified after completing every 10 analyses or after every 2 hours, whichever is more frequent. (Refer to SW-846 Methods 6010B, 9010B, 7470, and 7471A.) The standard solutions to be used for such continuing calibrations will be either EPA solutions, National Bureau of Standards SRM1643a solutions, or contractor-prepared standards according to the analytical method. Control limits for these analyses are the same as for ICV analyses. DQI-Precision.

8.1.18 Interference Check Sample (ICS)

An interference check sample (ICS) is analyzed for the ICP analysis at a frequency defined in the SW-846 (6010B) to verify interelement and background correction factors. The ICS consists of one solution containing interferents, and a second containing analytes mixed with the interferents. The second solution must fall within ±20% of the true value. Corrective action must be taken if this criterion is not met. DQI-Precision.

8.1.19 Secondary Column Confirmation

For gas chromatographic analyses, a GC column with a different coating or packing is used as a second analysis for all samples with detections in the primary analysis. This second analysis confirms the presence or absence of the detected analyte. DQI-Precision.

8.1.20 Performance Evaluation Sample

Performance evaluation (PE) samples are prepared externally to the laboratory to assess the ability of the laboratory to accurately perform the relevant analyses. The samples are fortified with known concentrations of analytes of interest, and submitted to the laboratory with field sample delivery groups. PE samples will be supplied by USACE throughout this project. WESTON's Laboratory QA/QC Coordinator will have the PE sample results scored by the Office of Environmental Measurement Evaluation (OEME) QA office and subsequently will distribute PE result scores to both USACE and EPA. In addition, *Laboratory Data Validation*

Functional Guidelines for Evaluating Environmental Analyses (99-0100) will be used for evaluation/validation of the PE scores. DQI-Accuracy/Bias.

8.1.21 System Performance Check Compounds (SPCCs)

SPCCs are specific compounds used to monitor the relative response factors (RRFs) of continuing calibration checks as compared to the initial calibration for GC/MS analyses of VOCs (SW-846 8260B) and SVOCs (SW-846 8270C). A minimum RRF for each of the SPCCs must be achieved in order for the initial calibration to be valid. DQI- Accuracy/Bias.

8.1.22 Calibration Check Compounds (CCCs)

CCCs are specific compounds used to monitor the RRFs of continuing calibration checks as compared to the initial calibration for GC/MS analyses for VOCs and SVOCs. The percent difference of the RRFs for each CCC must be less than or equal to 20% in order for the initial calibration to be valid, as defined in SW-846, Methods 8260B and 8270C. DQI-Accuracy/Bias.

8.2 STANDARDS AND TRACEABILITY

Analytical standards are prepared from pure compounds or are purchased-prepared from reputable vendors. These standards provide the stock used to prepare serial dilutions for calibration and spiking standards. Each laboratory section is responsible for the preparation, storage, and disposal of its standards. Pertinent standards preparation information is recorded into section-specific standard logbooks to document traceability of prepared standards to their source material(s).

Each standard is given an internal identification number. The preparation of all stock standards shall be documented in a standards notebook, which is used to record the date of preparation, analyst's initials, source of the reference material, standard components, amounts used, final volume, final concentration(s), solvent used, expiration date of prepared standard, and the assigned serial reference number (internal identification number) of the stock solution. All standards shall be labeled, at minimum, with the standard serial reference number and expiration date, and, if space permits, the name of the standard, concentration, date of preparation, and

initials of the preparer. All diluted working standards not consumed during an analytical session shall be labeled fully, including the serial reference number of any stock standard used in its preparation.

If no expiration date has been assigned by the manufacturer, an expiration date of 1 year from the date of preparation is generally reported, unless degradation prior to this date is observed. The expiration date assigned to a prepared standard shall not exceed the expiration date of any individual component in the solution. To help determine if a standard has degraded, one must note inconsistencies. For instance, very poor recoveries from newly prepared quality control spikes or abnormally low instrument response to a specific standard are indications of possible standard degradation. However, for some standards, degradation is more easily noted. If degradation is observed before the default expiration date, it should be noted in the standards notebook for that standard entry and the standard removed from service.

Reference standards must be traceable to national standards of measurement (e.g., NIST), whenever possible. Standards used for calibration must be traceable, when possible, to national standards of measurement, either directly through supplier documentation or by verification against a second source, traceable reference standard.

9. DATA REDUCTION, VALIDATION, AND REPORTING

The data reduction, validation, and reporting procedures described in this section will provide that complete documentation is maintained, that transcription and data reduction errors are minimized, the quality of the data is reviewed and documented, and the reported results are properly qualified.

9.1 FIELD AND TECHNICAL DATA

The field and technical (nonlaboratory) data that will be collected during a field effort can generally be characterized as either "objective" or "subjective" data. Objective data (e.g., field test kit results) include all direct measurements of field data such as field screening/analytical parameters and water level measurements. Subjective data include descriptions and observations such as descriptions of sampling locations and conditions, and physical descriptions of auger samples.

Field data collected during the field activities will be evaluated for usability by conducting a QA review, which will consist of checking the procedures used and comparing the data to previous measurements. Field QC samples will be evaluated to ensure that field measurements and sampling protocols have been observed and followed. These checks will include:

- Use of standard operating procedures (SOPs).
- Calibration method and frequency.
- QC lot number.
- Date and time sampled.
- Preservation.
- Samplers.
- Laboratory.
- Chain-of-custody forms.
- Date shipped.

QA review of data obtained from field measurements will be performed by the field staff. The validity of all data will be determined by checking calibration procedures used in the field and by comparing the data to previous measurements, if any, at the specific site. Large variations (greater

than 50%) will be examined for possible re-collection of data or assignment to a lower level of validity.

9.1.1 Data Reduction

Geologic logging data will undergo field QC checking and a later technical review after entry into a geologic logging and data management system. Subjective data will be filed as hard copies for later review and incorporation into technical reports, as appropriate.

The subjective data will be formatted into a usable medium, such as a computer database program. The database will allow the generation of summary tables, graphs, and figures while maintaining the integrity and accountability of the original data.

9.1.2 Data QA Review

The QA review for usability of objective field and technical data will be performed at two different levels. In the first level, data will be reviewed at the time of collection by following standard procedures and QC checks. In the second level, after data reduction into tables or arrays, the data will be reviewed for anomalous values. Any inconsistencies or anomalies discovered by this review will be immediately resolved, if possible, by seeking clarification from the field personnel responsible for collecting the data. All inconsistencies and anomalies will be documented during the validation process.

Subjective field and technical data will be approved for use by review of field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made to check recorded data at that time to confirm the recorded observations. Whenever possible, peer review also will be incorporated into the data QA review process, particularly for subjective data, in order to maximize consistency among field personnel. For example, during drilling activities, scheduled periodic reviews of archived lithologic samples will be performed to ensure that the appropriate lithologic descriptions and codes are being consistently used by all field personnel.

9.2 LABORATORY DATA DOCUMENTATION

Laboratory data production and management will be described in the laboratory QAPP. Records of the analytical data and project files will be retained by the contractor for a minimum of 5 years.

9.2.1 Data Reduction

Data reduction is performed by the individual analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will depend on the specific analytical method and the number of discrete operations (extractions, dilutions, and levels/concentrations) involved in obtaining a sample that can be measured.

For those methods using a calibration curve, sample response will be applied to the linear regression line to obtain an initial raw result, which is then factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained to minimize rounding errors, and results will not normally be expressed in more than two significant figures.

Copies of all raw data and calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

9.2.2 Laboratory Data Review

System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, QC sample results, and performance evaluation samples. These reviews are performed prior to submission to the laboratory manager.

Criteria for analytical data review/verification include checks for internal consistency, transmittal errors, laboratory protocol, and laboratory QC. QC sample results and information documented in field notes will be used to interpret and evaluate laboratory data. The QA Section independently conducts a review of the data package to eliminate technical errors that might affect the quality of the data.

The laboratory will complete standard review procedures, including:

- Proofing analyses requested with analyses performed.
- Preliminary data proofing for anomalies—investigation and corrections, where possible.
- Proofing of laboratory data sheets for reporting limits, holding times, surrogate recovery performance, and spike recovery performance.
- Double-checking computerized data entry, if required.

The laboratory manager or group leader will review data for consistency and reasonableness with other generated data and determine whether program requirements have been satisfied. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analyses should be repeated.

Prior to final review/signoff by the laboratory manager or group leader, the Data Reporting Section will verify that the report deliverable is complete and in proper format, and screen the report for compliance with laboratory and client QA/QC requirements. The laboratory manager or group leader will be the final laboratory review prior to reporting the results to the Technical Consultant Leader. The laboratory manager will also do a final completeness check before submitting the data report to the client.

The QA Section will independently conduct a complete review of selected projects to determine whether laboratory and client QA/QC requirements have been met. Discrepancies will be reported to the laboratory manager or group leader for resolution.

9.2.3 Data Reporting/Deliverable Package

All data resulting from the investigation will be presented in written reports. The reports will consist of a presentation of the raw analytical data, summaries of the review and verification effort, as appropriate, as well as interpretative findings relative to the data. This information will allow new data validation to be performed.

Reports will contain final results (uncorrected for blanks and recoveries), analytical methods, detection limits, surrogate recovery data, method blank data, and results of QC samples (where

applicable). In addition, special analytical problems and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (e.g., micrograms per liter [µg/L]). Concentrations in solid or semisolid matrices are expressed in terms of weight per unit weight of sample [e.g., milligrams per kilogram (mg/kg)].

The final data report provided by the laboratories will include:

- Cover page/laboratory chronicle.
- Chain-of-custody sample request form.
- Sample data (including QC sample) results.
- Case narrative describing data qualifiers, sample collection, sample preparation and analysis dates, and a description of any technical problems encountered with the analysis.

Additional information provided in the report will consist of, as appropriate (i.e., for samples to be subjected to data validation):

- Associated raw data (e.g., chromatograms) for standards and samples (including calibration).

QC results include a method blank, matrix spike/matrix spike duplicates (MS/MSDs), a method blank spike, and the results of the field QA samples, in addition to laboratory control samples (LCSs). Sample data results, including QC sample results, will also be delivered in an electronic format for input into the program data management system. Laboratories are responsible for reviewing the electronic deliverable to ensure that the electronic data matches the hard copy reports.

9.2.4 Data Review and Validation

The purpose of analytical data validation is to eliminate unacceptable data and to qualify data for any data quality limitations identified during validation. In addition to the laboratory QA review, all data deliverables will be evaluated at a minimum, for the following:

- Compliance with requested testing.
- Completeness of analytical report.
- Confirmation of receipt of all requested deliverables.
- All data collected for analyses will be fully validated by an independent contractor unless otherwise specified. Data validation will consist of U.S. EPA Region Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, (April 1993) and National Functional Guidelines for Organic Data Review (September 1994)

At a minimum, all data will be reviewed by the Project QA Coordinator, or other QA staff, to evaluate the sampling and analytical performance. Using the following procedure, this primarily is applicable to data for which final data validation will not be performed:

- Review of chain-of-custody documents to verify sample identities.
- Review of sample log-in documents to verify any potential problems with custody seals, container integrity, sample preservation, labeling, etc.
- Review of trip blank data to identify any potential problems with sample container contamination, preservation contamination, laboratory reagent water contamination, or cross-contamination between samples during transport.
- Review of method blank data to determine the presence of any sources of contamination in the analytical process.
- Review of the matrix spike (MS) data to evaluate the potential for matrix effects and as a measure of analytical accuracy. MS recoveries will be compared against the acceptance criteria in Section 8 to determine if they are within or outside of warning and control limits for percent recoveries.
- Review of matrix spike/matrix spike duplicate (MS/MSD) data to evaluate sample homogeneity and as a measure of analytical precision. MS/MSD data will be compared to the acceptance criteria in Section 8 for the maximum relative percent difference (RPD).

- Review of any blank spike (BS) data (if available) as a measure of analytical accuracy. BS recoveries will be compared against the acceptance criteria to determine if they are within or outside of warning and control limits for percent recoveries.

- Review of blank spike and blank spike duplicate (BS/BSD) data (if available) as a measure of analytical precision. BS/BSD data will be compared to the acceptance criteria for the maximum RPD.

- Review of standard reference material (SRM) or laboratory control sample (LCS) data (if available) as a measure of analytical accuracy. SRM and LCS data will be compared to the certified acceptable ranges of analytical values.

- Review of sample and sample duplicate data (if available) as a measure of sample homogeneity and as a measure of analytical precision. Sample and sample duplicate data will be compared against the acceptance criteria for the maximum RPD.

- Review of surrogate recovery data to access extraction efficiency, effectiveness of sample introduction, and possible loss during cleanup activities. Surrogate recoveries will be compared to the acceptance criteria to determine if they are within or outside of acceptable limits.

- Review of sample data, extraction/digestion dates, and analysis dates to determine if maximum holding times were met or exceeded.

- Identify and report any potential problems, such as MS or RPD values outside of acceptance criteria.

This process will identify analytical methods and compounds for which the QA objectives are not satisfied and corresponding sample data will be qualified with a "flag" indicating the problem. Samples collected on the same day, or analyzed in the same run or batch, or individual samples may be flagged, depending on the type of problem that has been identified. Reanalysis or resampling may be recommended as a corrective action at this time if data are determined to be unacceptable for the intended application. Data assessment procedures and the corresponding corrective actions are described in Sections 12 and 13.

QC results will be reported by sample matrix and analytical method in tabular form. The measurement data will be discussed and qualified, as appropriate, based on the QC results. For example, matrix spike interference will influence specific samples or matrices, while laboratory blank contamination will influence all samples extracted or analyzed on a specific day or during a specific analytical run.

In cases where there is a large number of QC analyses of one type, a second level, or summary, table may be constructed. The summary tables will typically report mean or pooled statistics to describe the overall performance of the method. For example, the summary table of duplicate sample results might report the average RPD for all duplicates measured for the compound, and indicate the number of individual RPDs that did not meet the acceptance criteria. This type of table can serve as an indication of the overall QC results. However, these applications will often have to be developed or modified from existing programs for individual investigations. A summary assessment of the data presented in these tables will be prepared for each phase of sampling, as appropriate.

Custom table formats will be used as an aid to interpretation of the investigative data. The particular format will depend on how the QC results are expected to influence the investigative data and will be developed by data management staff through discussion with the users. For example, QC results may be grouped with analytical batches, field collection batches, or summarized for the entire project.

The data validation report (for samples subject to full data validation) will include a narrative explanation of what samples the report applies to, a reference to the criteria or procedures used to qualify the data, a form summarizing results with data qualifiers (in accordance with U.S. EPA *Region Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, [April 1993] and *National Functional Guidelines for Organic Data Review* [September 1994], which allows for hand annotated qualifiers on laboratory report forms) and a description of which results were qualified and why. This report will accompany the QC data summary.

9.3 DATA ARCHIVING

Field, laboratory, and cartographic data within the laboratories' database system collected from the sites during sampling will be archived on magnetic tape. Backup tapes containing databases and programs or software utilities will be maintained in a secure location.

9.4 STANDARD PLANS AND REPORTS

Project reports will include a section (or appendix) on QA review. This review will summarize field documentation, field audits, field screening, sample collection and method analysis, duplicate samples, field blanks, trip blanks, sample holding times, MS recoveries, surrogate recoveries, MSD results, and laboratory method blank results. Any corrective actions taken will also be discussed.

10. PERFORMANCE AND SYSTEM AUDITS

10.1 PERFORMANCE AND SYSTEM AUDITS AND FREQUENCY

There are two types of audits (assessments) that may be performed by WESTON: a technical system audit (TSA) or a performance assessment. A system audit is a planned and documented evaluation of a system or process to determine whether the system or process is capable of complying with specific requirements. For example, a system audit may be performed to determine whether a laboratory can meet the QA/QC Plan requirements for a specific analysis. A performance assessment is a planned and documented evaluation of an item, system, process, or results to determine the adequacy of and the compliance with established procedures, instructions, drawings, project plans, and other documents. For example, a performance assessment may be performed to determine how well a field team is complying with contract and Chemical QA/QC Plan specifications.

10.2 TECHNICAL SYSTEM AUDITS (TSA)

10.2.1 Subcontractor Audits (Fixed Laboratory)

A subcontractor audit will be performed at least once during this program. In the event that laboratory performance does not meet QAPP requirements and/or significant data quality issues arise, WESTON reserves the right to perform additional system/project audits at any time throughout the program.

Checklists are to be used to ensure that all salient points are addressed and documented. The checklists are filled out legibly and reproducibly, in ink, by the auditor, and are signed and dated by the auditor when completed. The audit checklist is based on U.S. EPA laboratory evaluation criteria, the provisions of the Laboratory Quality Assurance Manual, and the laboratory SOPs. Audit checklists will cover at least the following areas:

- Systems Audit
  - Personnel qualifications and training records.

- Adequacy of laboratory facilities, including work space, lighting, ventilation, and supplies.
- Maintenance and calibration recordkeeping for analytical equipment.
- Safety (facility configuration and practices).
- General operations, including glassware cleaning, inventory and checking of reagents and standards, and storage procedures.
- Recordkeeping, including sample log-in and tracking; traceability of standards, control charts; and raw data recording and tracking.

▪ Project Audit

- Sample log-in and chain-of-custody records.
- Sample storage procedures and records.
- Sample preparation and analysis procedures.
- Method validation (where applicable).
- Conformance to QAPP.
- Control charts (if applicable).
- Precision and accuracy assessment.
- Method blanks, reagent blanks, duplicates, check samples, fortifications, surrogates, etc.
- Calibration.
- Data packages.
- Analyst qualifications.
- Data validation and reporting.

Each system audit is immediately followed by a debriefing in which the auditor discusses his/her findings with the laboratory representatives. The debriefing serves a twofold purpose: (1) laboratory management is afforded an early summary of findings, which allows them to begin formulating corrective strategies; and (2) the auditor has a chance to test preliminary conclusions and to correct any misconceptions before drafting his/her report.

The records from these assessments will be included in the project file. An abbreviated summary of the audits, including the name of the laboratory, the project for which the audit was performed, and the overall rating of the laboratory (acceptable or unacceptable), will be submitted to procurement for tracking. If a laboratory is assessed unacceptable, corrective actions will be implemented.

11. PREVENTIVE MAINTENANCE

The primary objective of a preventive maintenance program is to promote the timely and effective completion of a measurement effort. The preventive maintenance is designed to minimize the downtime of crucial sampling and/or analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas.

- Establishment of maintenance responsibilities.
- Establishment of maintenance schedules for major and/or critical instrumentation and apparatus.
- Establishment of an adequate inventory of critical spare parts and equipment.

11.1 RESPONSIBILITIES AND PROCEDURES

Equipment and apparatus used in the Contractor's environmental measurement programs fall into two general categories:

- Equipment permanently assigned to a specific laboratory {e.g., gas chromatography (GC) laboratory}.
- Field sampling equipment available for use on an as-needed basis (e.g., field meters, pumps, and vehicles).

Maintenance of laboratory instruments is the responsibility of the laboratory contracted to perform the analytical portion of this program. Generally, the laboratory manager or supervisor of a laboratory is responsible for the instruments and equipment in his or her work area. The laboratory manager will establish maintenance procedures and schedules for each major equipment item. This responsibility may be delegated to laboratory personnel, although the managers retain responsibility for ensuring adherence to prescribed protocol. All laboratories are bound by analytical contractual agreements to maintain the ability to produce data that meet the project objectives and to follow method specifications. This ensures that adequate spare parts, maintenance, schedules, and emergency repair services are available.

Maintenance responsibilities for field equipment are assigned to the field sampling team. However, the field team using the equipment is responsible for checking the status of the equipment prior to use, and reporting any problems encountered. The field team is also responsible for ensuring that critical spare parts are included as part of the field equipment checklist. Non-operational field equipment is removed from service and a replacement obtained.

11.2 FIELD EQUIPMENT

As discussed in Section 6 of this QAPP, the field equipment will have been properly calibrated, charged, and in good general working condition prior to the beginning of each working day. Maintenance and calibration of equipment prior to field use will be a prerequisite. As appropriate, field instruments will be maintained in accordance with manufacturers' specifications. When used, field test kits will be inspected and associated monitoring equipment will be maintained in accordance with manufacturers' specifications.

All field instruments and field test kits will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of the ranges that will be encountered during cold-weather working conditions. At the end of each working day, all field equipment will be taken out of the field and placed in a cool, dry room for overnight storage. Field instrumentation and equipment maintenance, repair, and calibration procedures will be in accordance with the manufacturers' specifications.

All subcontractor equipment (e.g., drill rigs, water trucks, etc.) will arrive at the site each day in proper working condition. All lubrication, hydraulic, and motor oils will be checked by the subcontractors prior to the start of each working day to ensure that all fluid reservoirs are full and that there are no leaks.

Prior to the start of each working day, the field sampling team will also inspect all equipment for fluid leaks. If a leak is detected, the equipment will be removed from service for repair or replacement.

11.3 LABORATORY EQUIPMENT

11.3.1 Maintenance Schedules

The ability to generate valid analytical data requires that all analytical instrumentation be properly maintained. The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each major equipment item. Other maintenance activities are conducted on an as-needed basis. Each laboratory will be responsible to maintain full-service contracts or in-house service personnel for all major instruments. These service contracts should not only provide routine preventive maintenance, but also emergency repair service. Manufacturers' recommendations will provide the primary basis for the established maintenance schedules, and manufacturers' service contracts provide the primary maintenance for many major instruments (e.g., GC instruments, and analytical balances). The elements of an effective maintenance program include the following, which are discussed in the ensuing subsections:

- Instrument maintenance logbooks.
- Instrument calibration and maintenance.
- Available spare parts.

A guide of preventive maintenance procedures to be followed by the laboratories is provided in Table 11-1.

11.3.2 Instrument Maintenance Logbooks

Each analytical instrument will be assigned an instrument logbook. All maintenance activities are to be recorded in the instrument logbook, and the information entered to include:

- Date of service.
- Person performing service.
- Type of service performed and reason for service.
- Replacement parts installed (if appropriate).
- Miscellaneous information.

If service is performed by the manufacturer, a copy of the service record will be taped into the page facing the notebook page or filed separately where the above information is entered.

Table 11-1

Typical Laboratory Equipment and Maintenance

Instrument	Procedure	Frequency
AA (Graphite Furnace)	Clean optics and windows	Daily
	Replace windows	As required
	Check or change cuvette	Daily
	Check and drain compressor drain	Daily
	Clean atomizer cell	Daily
	Nebulizer cleaned/dried	Weekly or as required
	Check/change marble stones	Weekly
	Clean filters	Weekly
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check/clean torch and carbon ignition tip	Weekly
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required
UV-Vis Spectrophotometer	Check tubing	Daily
	Clean ambient flow cell	Quarterly
	Precision check/alignment of flow cell	Quarterly
	Clean printer head	When changing paper or if print too light
	Wavelength verification check	Semiannually
Hewlett Packard GC/MS	Ion gauge tube degassing	As required
	Pump oil-level check	Monthly
	Pump oil changing	Semiannually
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	As required

Table 11-1 (Continued)

Typical Laboratory Equipment and Maintenance

Instrument	Procedure	Frequency
Hewlett Packard GC/MS (Continued)	COMPUTER SYSTEM AND PRINTER: Air filter cleaning Change data system air filter Printer head carriage lubrication Paper sprocket cleaning Drive belt lubrication	As required As required As required As required As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily Annually
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Warning system checked Temperature adjustment Defrosting/cleaning	Daily Monthly As required As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semiannually
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check recorder zero and noise level Check carrier gas flow rate in column Check temp. of detector, inlet, column oven Septum replacement Glass wool replacement Check system for gas leaks with SNOOP Check for loose/fray wires and insulation Column temperature verification	Daily Daily Daily via use of known compound retention Daily As required As required Monthly or w/cylinder change Monthly Daily

Table 11-1 (Continued)

Typical Laboratory Equipment and Maintenance

Instrument	Procedure	Frequency
Gas Chromatograph (Continued)	Visually check for shifting of column packing material resulting in forward movement beyond the bottom of the column exit or settling in excess of 1/2 inch from the glass wool plug at the column inlet	Weekly or as needed
Water Baths	Temperature monitoring Water replaced	Daily Monthly or as needed
Hall 700A Detector Hall 1000 Detector	Electrolyte change Reactor tube/Teflon connecting tube change Clean detector cell	As required by noise Semiannually or as required As required
Photoionization Detector (PID)	Change O-rings Clean lamp window	Yearly As required
Radiological Survey/ Analysis Instruments	In accordance with manufacturers' specification	As required
Instrumentation for ACM Analysis	In accordance with manufacturers' specification	As required
Flame Ionization Detection	In accordance with manufacturers' specification	As required

11.4 SPARE PARTS

Along with a schedule for maintenance activities, an adequate inventory of spare parts is useful to minimize equipment down time. The inventory includes those parts (and supplies) that:

- Are subject to frequent failure;
- Have limited useful lifetimes; or
- Cannot be obtained in a timely manner should failure occur.

The laboratory managers will be responsible for maintaining an adequate inventory of spare parts (e.g., spare sources, batteries, vacuum pumps, and filaments for GC/MS; and spare torches and burner heads for AA-ICP). The instrument operators have the responsibility, with the appropriate Laboratory Project Manager or Group Leader, to ensure that an acceptable inventory of spare parts is maintained.

In addition to spare parts and supply inventories, a backup supply of the pertinent equipment and instrumentation for the field sampling will be maintained.

12. PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

The evaluation/assessment of measurement data is required to ensure that the QA objectives for the program are met and that quantitative measures of data quality are provided. The data evaluation procedures, calculations and applications used for this project are based on the U.S. EPA *Region Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, (April 1993) and *National Functional Guidelines for Organic Data Review* (September 1994).

A distinction must be made between routine QC and data assessment that is conducted as a part of laboratory operations, and the project-related data assessment process conducted after the data have been reported. It must be assumed that the planning, standard procedures, and monitoring activities conducted during the sampling and analysis process have served to control the process as much as possible to produce data of sufficient quality for project needs. After the data have been reported, it is necessary to identify any part of the process that could not be controlled, and to what extent that may affect the quality of the reported data.

The routine quality control procedures conducted in the laboratory are established in the published methods, this document, and the analytical SOPs. The laboratory is responsible for following those procedures and operating the analytical systems within statistical control limits. These procedures include proper instrument maintenance, calibration and continuing calibration checks, and internal QC sample analyses at the required frequencies (i.e., reagent blanks, surrogate spikes, matrix spike/matrix spike duplicate [MS/MSD], analytical spikes, laboratory duplicates). One of the additional ongoing data assessment processes is maintaining control charts for representative QC sample analyses to monitor system performance. This provides verification that the system is in statistical control and indicates when performance problems occur, so the problems can be corrected as soon as possible. When reporting the sample data, the laboratory is required to provide the results of associated QC sample analyses so the project staff can evaluate the performance of the analytical process.

Problems with analytical data often occur in spite of all precautions taken in planning and execution of the sampling and analysis task. In these cases, the data assessment conducted by the project QA staff after the data have been reported must identify the problem, determine which data are affected, state how these data may be limited for use in the intended applications, and make recommendations for corrective actions, as necessary.

The discussion of data assessment presented in this section pertains to the project-related assessment of data that is performed after data have been reported and laboratory analyses have been completed.

Data assessment procedures that will be performed for projects at the WKI facility include:

- Initial review of analytical and field data for complete and accurate documentation, holding time compliance, and required frequency of QC samples.
- Evaluation of blank results to identify systematic contamination.
- Statistical calculations for accuracy and precision using the appropriate quality control sample results.
- Estimates of completeness, in terms of the percent of valid unqualified data.
- Assigning data qualifier flags to the data as necessary to reflect limitations identified by the process.

Qualified data will be discussed in the task reports, and data flags can be transmitted to users via data tables from the database and in analytical data reports.

12.1 FORMULAS

Several of the data validation acceptance criteria involve specific calculations. The appropriate formulas are presented below.

12.1.1 Instrument Response Linearity (Calibration)

Acceptance criteria for instrument response linearity checks are based on the correlation coefficient, r, of the best fit line for the calibration data points. The correlation coefficient reflects the linearity of response to the calibration standards and is calculated as:

$$r = \frac{n\sum(xy) - \left(\sum x\right)\left(\sum y\right)}{\sqrt{\left[n\left(\sum x^2\right) - \left(\sum x\right)^2\right]\left[n\left(\sum y^2\right) - \left(\sum y\right)^2\right]}}$$

where:

x = Calibration concentrations;

y = Instrument response (peak area); and

n = Number of calibration points (x, y data pairs).

12.1.2 Precision

The degree of agreement between the numerical values of a set of duplicate samples performed in an identical fashion constitutes the precision of the measurement.

During the collection of data using field methods and/or instruments, precision is checked by reporting measurements at one location and comparing results. For example, water level measurements would be taken three times at a well and the values compared. The measurements are considered sufficiently precise only if the values are within a specified percentage of each other.

Control limits for control sample analyses, acceptability limits for replicate analyses, and response factor agreement criteria specified for calibration and internal QC checks are based on precision, in terms of the coefficient of variation (CV) or the relative percent difference (RPD). The standard deviation (S) of a sample set is calculated as:

$$S = \sqrt{\frac{\sum(x - \bar{x})^2}{(n-1)}}$$

where:

x = Individual measurement;

$\bar{x}$ = Mean value for the individual measurements; and

n = Number of measurements.

The CV as a percentage is then calculated as:

$$CV = \left(\frac{S}{\bar{x}}\right) \times 100$$

The RPD calculation allows for the comparison of two analysis values in terms of precision with no estimate of accuracy. Relative percent difference is calculated as:

$$RPD = \frac{|M - m|}{\left(\frac{M + m}{2}\right)} \times 100$$

where: M = First measurement value; and

m = Second measurement value.

For duplicate measurements, CV is related to RPD by the following:

$$CV = \frac{RPD}{\sqrt{2}}$$

12.1.3 Accuracy

Accuracy is the degree of agreement of a measurement, X, with an accepted reference or true value, T. Accuracy is usually expressed as the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100(X-T)/T, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias in a system and is assessed by means of reference samples and percent recoveries. Error may arise from personal, instrumental, or method factors.

The accuracy of data collected using field instruments is difficult to quantify. However, it can be qualitatively maximized by strict adherence to standard protocols and, where applicable, to manufacturers' operating and calibration procedures. This will ensure that the data are accurate and within the manufacturer's reported accuracy limits.

Two types of analytical check samples are used: laboratory control samples (blank spike) and the matrix spike. Analytical accuracy is expressed as the percent recovery of an analyte that has been

added to the control samples or a standard matrix (e.g., blank soil, analyte-free water, etc.) at a known concentration prior to analysis.

The accuracy of data is typically summarized in terms of relative error (RE). This calculation reflects the degree to which the measured value agrees with the actual value, in terms of percent of the actual value. Relative error is calculated as:

$$\% \text{ RE} = \frac{\text{Measured Value} - \text{Actual Value}}{\text{Actual Value}} \times 100$$

This way of expressing accuracy allows for a comparison of accuracy at different levels (e.g., different concentrations) and for different parameters of the same type (e.g., different compounds analyzed by the same method). Control sample analyses are typically evaluated using this calculation.

In this program, another calculation is frequently used to assess the accuracy of a procedure. Percent recovery is a calculation used to determine the performance of many of the QC checks, where:

$$\% \text{ Recovery} = \frac{\text{Measured Value}}{\text{Actual Value}} \times 100$$

Another similar calculation used to determine the performance of a method for recovery of a spike concentration added to a sample is the percent spike recovery calculation. The percent spike recovery is determined as:

$$\% \text{ Spike Recovery} = \frac{[(\textit{Measured Sample Value Plus Spike}) - (\textit{Measured Sample Value})]}{(\textit{Value of Spike Added})} \times 100$$

12.2 CONTROL LIMITS

Control limits for central tendency and variability are generated by the laboratory to statistically monitor system performance. These limits are within method specified tolerances. Since control limits may change as the analytical system is improved and matrices change, these limits are not provided in this plan.

12.3 DOCUMENTATION

Data reviewed to perform each of the above procedures and the implications to natural sample results are discussed in each of the following subsections.

12.3.1 Blank Data Assessment

Reagent blank results indicate whether any of the contaminants reported in sample results may be attributed to laboratory sources (reagents, glassware, instrumentation) and were not likely present in the sampled medium. The most common laboratory contaminants are methylene chloride, acetone, methyl ethyl ketone, and phthalates; these are recognized as being ubiquitous in the laboratory environment and controlling them to within acceptable low levels is part of standard laboratory procedures.

If contamination from these compounds is reported in reagent blanks, the samples associated with the blank, either the same analytical or extraction batch, may be qualified to indicate that some or all of these compounds may be from laboratory sources. If the concentrations reported in the samples are similar to the blank concentrations, it is likely that all of the contamination was introduced, and this assessment is made in the QA/QC report for the sampling task.

Results for other types of blanks such as equipment or trip blanks are assessed individually. The probable source of contamination is identified and the associated sample results are qualified as necessary. For example, if equipment blank results show contamination, and the sample collected from the sampling device (e.g., split spoon or bailer) shows the same compound, the sample results will be qualified to indicate the probable level of introduced contamination.

12.3.2 Accuracy

As previously defined, accuracy is associated with correctness, and is a comparison between a measured value and a known, or "true" value. Accuracy is calculated from method spike (spikes of the pure matrix), matrix spike, or LCS results.

Spike results are reported by the laboratory as percent recovery and are compared to the accuracy objectives stated in Section 3. Results that do not satisfy the objectives are assigned a data qualifier flag to indicate uncertainty associated with inaccuracy.

Method spikes are spikes of a reference material into a water matrix. If recovery is outside the established limits, samples from the same extraction batch may be qualified. Matrix spike results are generally more sample specific. If matrix spike recovery is outside the established limits, results for samples collected from similar conditions and/or handled in the same batch will be examined. If any results appear atypical and can be related, those results may also be qualified. The flagged data will be discussed in the QA/QC report for the sampling task, and specific limitations such as poor or enhanced recovery for specific compounds will be stated. Further investigation or corrective action may be taken to find methods to reduce the interferences.

Surrogate spike results are also reported and used to assess recovery of target analytes on a sample-by-sample basis and provide a measure of system performance. Surrogate spike recoveries are compared to recovery limits. Any results outside the limits are flagged on laboratory reports and in the database. Any corrective action taken in the laboratory is documented in laboratory performance records and/or discussed in the data report.

Confidence intervals can be calculated for an analytical method if performance audit samples are submitted or a series of method spikes are analyzed. The results are used to define confidence intervals for the recovery of each compound analyzed.

12.3.3 Precision

Precision is a measure of variability between duplicate or replicate analyses, and is calculated for field and laboratory replicates. By definition, field or total precision incorporates laboratory precision. Precision is calculated as the RPD between duplicate samples or analyses, or matrix spike/matrix spike duplicates as appropriate. The calculated RPDs for laboratory QC samples are compared to the objectives stated in Section 8. The calculated RPDs for field duplicates will be compared to the project goal of 50%. Results that do not satisfy the objectives are assigned a data qualifier flag indicating uncertainty associated with imprecision.

An average RPD may be calculated and reported as a measure of overall analytical precision for compounds with multiple measurements. The specific samples collected or analyzed in duplicate are flagged if they do not satisfy the QA objectives. In addition, associated samples may be flagged to indicate variability due to poor precision. For poor field duplicate precision, samples collected by the same sampling team, from the same equipment, or on the same day may be affected; close evaluation of those results should indicate the most likely source of variability, and the corresponding samples will be qualified as warranted. For poor laboratory precision, samples processed and analyzed in the same batch will be more closely evaluated, and any anomalous results will be qualified.

The QA Coordinator is responsible for ensuring that data qualifier flags are assigned to the data as required by the established QC criteria, and that they are reported and understood by project staff using the data for specific applications. The QA Coordinator is also responsible for initiating corrective actions for analytical problems identified during the QC data assessment process. These corrective actions range from verifying that the method was in statistical control during the analytical runs, to reanalysis of the sample, or resampling.

12.4 COMPLETENESS

Completeness is a measure of the degree to which the amount of sample data collected meets the scope and a measure of the relative number of analytical data points that meet all of the acceptance criteria, including accuracy, precision, and any other criteria required by the specific analytical method used. Completeness is defined as a comparison of the actual numbers of valid data points and expected numbers of points expressed as a percentage.

The QA objectives for completeness will be based upon a project goal of 90%. The ability to meet or exceed this completeness objective depends on the nature of samples submitted for analysis. If data cannot be reported without qualifications, project completion goals may still be met if the qualified data, i.e., data of known quality even if not perfect, are suitable for the specified project goals.

Difficulties encountered while handling samples in the laboratory, as well as unforeseen complications regarding analytical methods, may affect completeness during sample analysis.

For example, the proposed analytical methods are intended to analyze "environmental samples" (low and medium-level concentrations). The applicability of these methods to analyze unknown or hazardous-level samples may result in poor performance, and, therefore, have an adverse effect on achieving the data completeness goal.

Access to various areas and/or media along with unanticipated difficulties with sample collection affect field data completeness. For example, poor sample recovery in a split-spoon sample reduced the number of soil samples that can be collected, and, therefore, affects the completeness.

The minimum goal for completeness will be 90%, and the ability to exceed this goal depends on the applicability of the analytical methods to the sample matrices analyzed, especially for organic analysis.

Completeness is calculated after the QC data have been evaluated, and the results applied to the measurement data. In addition to results identified as being outside of the QC limits established for the method, broken or spilled samples, or samples that could not be analyzed for any other reason are included in the assessment of completeness. The percentage of valid results is reported as completeness.

The completeness will be calculated as follows:

$$\textit{Completeness}\ (\%) = \frac{\mathrm{T} - (I + NC)}{\mathrm{T}}\ x\ 100$$

where:

T = Total number of expected measurements for a method and matrix;

I = Number of invalidated results for a method and matrix; and

NC = Number of results not collected (e.g., bottles broken etc.) for a method and a matrix.

12.5 REPRESENTATIVESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. The representativeness criteria is best satisfied by making certain that sampling locations are properly selected and a sufficient number of samples are collected. Representativeness is addressed by describing sampling techniques and rationale used to select sampling locations. EPA- and American Society for Testing and Materials (ASTM)-approved and standardized sampling procedures will be used to ensure the representativeness of sample data.

12.6 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The comparability of the data, a relative measure, is influenced by sampling and analytical procedures. By providing specific protocols to be used for obtaining and analyzing samples, data sets should be comparable regardless of who obtains the sample or performs the analysis.

The analytical laboratory will be responsible for enhancing comparability using the following controls:

- Use of current, standard EPA-approved methodology for sample preservation, holding, and analysis.
- Consistent reporting units for each parameter in similar matrices.
- EPA- or NIST-traceable standards, when available.
- Analysis of EPA QC samples, when available.
- Participation in inter-laboratory performance evaluation studies.

13. CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out of QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented should be documented in the Quarterly Progress Report. If the problem is analytical in nature, information of these problems will be promptly communicated to the U.S. EPA Project Manager. Implementation of corrective action will be confirmed in writing through the same channels. Any nonconformance with the established QC procedures in the QAPP or SAP will be identified and corrected in accordance with the QAPP and/or SAP.

13.1 FIELD ACTIVITIES

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the QAPP, etc.), sampling procedures and/or field analytical procedures require modification, etc., due to unexpected conditions. In general, the field sampling team may identify the need for corrective action. The field sampling team is responsible for verifying that all QC procedures are followed. If a problem occurs that might jeopardize the integrity of the project or cause a specific QA objective to not be met, the field sampling team will notify the Technical Consultant Leader. An appropriate corrective action will then be decided upon and implemented. The field sampling team will document the problem, the corrective action, and the results.

If at any time a corrective action issue is identified which directly impacts project DQOs, the U.S. EPA Project Manager will be notified.

13.2 LABORATORY ANALYSES

Corrective action in the laboratory may occur prior to, during and after initial analyses. The responsibility to monitor the quality of an analytical system lies with the individual contract laboratory. The laboratory will verify that all QC procedures are followed and that the results of

analysis of QC samples are within the acceptance criteria. This requires that the laboratory assess the correctness of the following items, as appropriate:

- Sample preparation procedure.
- Sample integrity.
- Initial calibration.
- Calibration verification.
- Method blank result.
- Laboratory control standard.
- Laboratory duplicate analysis.
- Fortified sample result.

If the assessment reveals that any of the QC acceptance criteria are not met, the laboratory must immediately assess the analytical system to correct the problem. The analyst will notify the laboratory manager of the problem and, if possible, will identify potential causes and corrective action.

The nature of the corrective action obviously depends on the nature of the problem. For example, if a continuing calibration verification is determined to be out of control, the corrective action may require recalibration of the analytical system and reanalysis of all samples since the last acceptable continuing calibration standard.

When the appropriate corrective action measures have been defined and the analytical system is determined to be "in control," the analyst documents the problem, the corrective action, and the data demonstrating that the analytical system is in control. Copies of the documentation are provided to the Section Manager for inclusion in the narrative.

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency noted in the case narrative. Where sample results are impaired, the laboratory manager will be notified and appropriate corrective action (e.g., reanalysis) will be taken.

The approach to corrective action procedures for individual analyses will be based on the recommendations included in the specific CLP or SW846 protocol and the analytical laboratory QAPP/SOPs.

14. QUALITY ASSURANCE REPORTING

The quarterly Progress Reports will contain QA discussions in which data quality information collected during the task is summarized. The quarterly Progress Reports will be the responsibility of WESTON and will include the laboratory data validation reports and discussions of any QA/QC issues, as well as any corrective action needed or taken.

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APPENDIX A
LABORATORY SOPs

SOP No.	Revision No.	Date	Page
UMV-SOP-8260	12	09/29/00	1 of 64

TITLE: Gas Chromatography Mass Spectrometry - Volatiles SW-846 Method 8260

Updated by:	Signature:	Date:
Matthew Kobus Unit Leader, GC/MS Volatiles		9/29/00

Approved by:	Signature:	Date:
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Raymond J. Frederici Quality Manager		9-29-00

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Attn: Douglas Godfrey
Roy F. Weston, Inc.

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

To outline the guidelines for the analysis of Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS) using SW-846 Methods 8260A, 8260B and 8000B as references. On occasion, clients request slight modifications to this Standard Operating Procedure (SOP). These modifications are addressed on a case-by-case basis and would be written into a Quality Assurance Plan (QAP), tech spec or appropriate and are not detailed here. The preparation of all volatile samples is also outlined in this SOP and is based on Methods 5000, 5030A and 5030B. Method 5035 may eventually be covered by a separate SOP, but can also be found in this SOP.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratories endeavor to keep reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement.

Method detection level studies are performed annually, and reporting limits are assessed. If the MDL does not meet the routine laboratory reporting limit or the method specified limit, it is repeated or the laboratory reporting limit is reassessed. If the laboratory continually demonstrates that the method reporting limits are not achieved, equipment, technique, and the method are reviewed to assure optimal performance or appropriate action is taken. Table 1 defines the laboratory's reporting limits and analyte list for SW-846 Method 8260.

1.1.3 Definitions

Refer to Section 3.0 of the laboratory's QAPP (UQA-SOP-QAPP).

1.2 Summary of Method

This method is used to determine volatile organic compounds in a variety of matrices. It is applicable to water, soil, sediment, sludge and waste drum samples.

This method can be used to quantify most volatile organic compounds that have a boiling point less than 200°F. It is also limited to those compounds that elute as sharp peaks from a capillary column. A listing of applicable compounds and their characteristic ions appears in Table 2.

A portion of sample, measured into a sample vessel, is purged with an inert gas. The volatile compounds are transferred to a trap, containing retarding materials.

The trap is then backflushed with the inert gas and rapidly heated to effectively transfer the compounds to the GC column. The GC oven is then temperature ramped to separate the compounds and introduce them to the source.

The mass filter separates the ions which are then detected by the analyzer. The data system then provides qualitative and quantitative information concerning the sample.

Instrument calibration occurs about every 12 hours, or prior to analysis. Instrument maintenance is performed as needed or daily basis.

2.0 INTERFERENCES

External interferences can be caused by contaminants from sample containers, preparative glassware and reagents, syringes and columns and manifest themselves as high background and/or discrete peaks. Some contaminants are also introduced through the sample vial seal and/or instrument sample connections. Proper glassware preparation, sample handling and instrument maintenance should eliminate these sources. A laboratory method blank (MB) is analyzed prior to any analysis to show absence of any contaminants. Reagent water sampled in the lab and carried through all field operations is also analyzed to show absence of contaminants from field sampling.

Carryover is also another source of contamination. Any time a high level sample is analyzed, the next sample in the batch is checked for carryover. If carryover is suspected, that sample is re-analyzed. The position is rinsed with methanol/water. If carryover is excessive and continues into the next samples, the batch is aborted/paused, the column and trap baked, and/or blanks analyzed until all contamination is absent. If

further response is required (i.e. trap replacement) it is documented in the maintenance logbook. Refer to Section 7.4 for information on preventive maintenance.

Internal interferences can be purged from the sample with the target compounds and appear as elevated baselines or distinct peaks. Internal interferences most often manifest themselves as low/high recoveries of surrogate/matrix spike compounds. Matrix interferences vary from sample to sample.

The volatile lab must be free of solvents. All analytes must be less than their EQL (Estimated Quantitation Limit). The volatile lab is under positive pressure to reduce lab contamination, however, intermittent low levels of acetone and methylene chloride may be detected, usually below the EQL. refer to Section 8.2 (Corrective Action) for clarification for blank contamination.

2.1 Estimated Quantitation Limits (EQL)

Estimated quantitation limits for each routinely analyzed compound appears in Table 1. EQL's are highly matrix dependent and will vary.

3.0 SAFETY

- As always, general laboratory safety practices should always be followed.
- Waste samples should be handled with care due to the uncertainty of the properties and contents involved.
- Refer to the specific MSDS for the hazardous properties of ANY chemical or reagent involved in this procedure.

4.0 EQUIPMENT AND SUPPLIES

4.1 GC/MS

A temperature programmable chromatograph interfaced with a mass-selective detector capable of scanning from 35 - 260 amu every second or less using 70 volts of electron energy in the electron ionization mode. The system is capable of producing an acceptable spectrum of bromofluorobenzene when 50 ng/5 mLs is purged.

4.2 Data System

Six analytical systems are interfaced with stand alone PC systems/win95 HP Chemstation acquisition software/peripheral hardware. All systems are capable of continuous acquisition and storage of mass spectral data. Completed data files are automatically transferred through the ChemLan to the Chermserver Target 3.5 processing software which is capable of plotting specific masses versus time or scan numbers and integration

of that abundance. The system also stores data. A version of the NBS library resides on the Chemserver.

4.2.1 Data File Name/Batch Directory Assignments

Each sample batch # is assigned a three letter code at the time that the first sample is analyzed. The codes are assigned sequentially in order to avoid duplication (i.e., AAA, AAB, AAC, AAD, etc.). The client name and the sample # are then logged into the three letter code book, in order to assure that the three letter code is not assigned to another sample batch. Each of the analyses that correspond to a specific sample # are then named numerically. (i.e., AAA01, AAA02, AAA03, AAA04, etc.). Tune, standard, blank, and LCS data files are designated by specific letters unique to each instrument in conjunction with the appropriate month and day (example : KA902 = instrument #3, first 12 hour tune, September 02). During transfer of the files to the Chemserver, a unique batch directory is created on Target per instrument, date and tune.

4.3 Current Hardware/Software

- 3 Hewlett-Packard 5890 GC interfaced with a 5971 MSD. Contains a DB-624 widebore capillary column.
- 4 Hewlett-Packard 5890 GC interfaced with a 5972 MSD. Contains a DB-624 widebore capillary column.
- 5 Tekmar 3000 in connection with 5 Tekmar 2016 ALS for all systems - 2 with Varian Archon AutoSamplers.
- 7 PC for data acquisition and file transfer to the Chemserver, equipped with Windows 95 Chemstation, ChemLan and Exceed software.
- HP Chemserver Software and peripheral hardware with Target 3.5 processing software and forms production software. Other hardware; HP X-Terminals (Exceed) and PC's with both Exceed and Novell LAN for access to other applications.
- A peripheral DAT drive and ARCserve software for automated system back-ups and data archival. Separate locked storage area for all data tapes. System maintains current logs to trace data to a specific back-up session and tape.

4.4 Miscellaneous

- assorted syringes (10, 25, 50, 100, 500 and 1000 mL)
- 5 mL and 25 mL luer-lock gas-tight syringes
- assorted purge vessels (water/soil, 5/25 mL, 5 g)
- top-loading balance, capable of weighing to $\pm$ 0.1 g, stainless steel spatula
- assorted amber and clear Teflon-lined screw-capped vials (1.5 - 2.0 mL, 3.5 - 5.0 mL)
- cleaned 40 mL vials w/Teflon-lined screw-caps
- Eppendorfs (1mL, 500uL, 100uL, 50 mL, 25 mL)*
- volumetric flasks (10mL, 25mL, 50mL, 100mL)

* Eppendorfs or syringes are calibrated and data documented in the controlled logbook located in the GC/MS VOA analysis lab.

5.0 REAGENTS AND STANDARDS

The majority of the calibration standards are either EPA certified, A2LA or second-source verified by the standard vendor in situations where suitable SRMs (Standard Reference Material) was available. For those compounds where standards must be made from neat material (due to instability) or some non-routine compounds, **where available**, a second-source is purchased and used in the Blank Spike [a.k.a., Laboratory Control Sample – LCS[1]] spike to verify the standard

[1] In LabNet, the Blank Spike corresponds to the Laboratory Control Sample and will be referred to as the LCS. When performed is duplicate, it will be referred to as the LCD.

Each time new standards are prepared and a new initial calibration is required, the standards are verified against a second-source LCS prior to any sample analysis. This holds for all routine compounds, and those available as second-source material in the LCS.

All neat standards/kits received are recorded in the LabNet system. A code is written on the bottle/kit and recorded in LabNet. All neat standards are then stored in a separate freezer at approximately -10°C until needed. The standard is issued a Neat Standards Reference Number (NSRN) which is used to track all standards as they are used as is or in preparation of stock/working solutions. The format of the standards in LabNet will prevent working or intermediate level solutions from being used past the expiration date of the neat or stock solutions.

5.1 Surrogate Spiking Solution

Stock surrogates are purchased as a mix from NSI or Restek . The following surrogates are used:

Compound	Concentration
4-Bromofluorobenzene	\
1,2-Dichloroethane-d_4	2500 ppm
Toluene-d_8	/
Dibromofluoromethane	

This is stored in a separate freezer at approximately -10°C in the dark and kept for a period of one year. If the stock solution has a manufacturer's expiration data, that is used. If a date is not evident, it is assigned one year. This procedure is used for all "neat" standards.

The contents of the ampules are transferred to a 1.5-2.0 mL amber Teflon-lined screw-capped vial upon opening. Once opened, they are used for a period of 6 months or until used. The transfer is recorded in LabNet. The standard is then issued a SRN (Standard

Reference Number) which can be traced back to : the NSRN in LabNet, date of receipt, date of opening, and the supplier. The same procedure is followed for all vial transfers. These are stored in a freezer at approximately -10°C in the dark. The working solution is prepared with internal standard solution. See next section.

5.2 Internal Standard Spiking Solutions

Stock internal standards are usually purchased as solutions from NSI or Restek. The following internal standards are used:

Compound	Concentration
Pentafluorobenzene	\
Chlorobenzene-d_5	2000 ppm
1,4-Difluorobenzene	/
1,4-Dichlorobenzene-d_4	

These are stored at -10°C in the dark. Unopened ampules are kept for a period of one year. Opened ampules are kept for a period of 6 months or until used. The contents of the opened ampules is transferred to a 1.5 - 2.0 mL amber Teflon-lined screw-capped vial. The WORKING internal standard/surrogate solutions can be prepared as follows:

Compound	Volume (mL)	MeOH (mL)	Concentration
Internal Standard			
Pentafluorobenzene	\	\ diluted to	\
Chlorobenzene-d_5	250	10 mL	50 ppm
1,4-Difluorobenzene	/	/	/
1,4-Dichlorobenzene-d_4			
Surrogate			
Bromofluorobenzene	\	\ diluted to	\
1,2-Dichloroethane-d_4	200	10 mL	50 ppm
Toluene-d_8	/	/	/
Dibromofluoromethane			

NOTE: All standard recipes are listed here in this SOP for guidelines for standard preparation. These recipes are subject to change.

These are stored in 1.5 - 2.0 mL amber Teflon-lined screw-capped vials at approximately -10°C in the dark. All standard preparation is recorded in the Volatiles Standard Logbook. Working internal standard and surrogate solutions are prepared every two weeks. Each standard is issued a Standard Reference Number (SRN). Addition of 5 mLs to 5 mLs/25 mLs volume results in a concentration of 50/10 ppb (soil/water).

All standard labels contain the following information: SRN, standard description, concentration, date prepared, analyst and expiration date. All neat standards are returned to storage.

5.3 Purgeable Standards Mixes/Neat Materials

These are obtained as neat standards/mixes from NSI, Restek or as indicated. The contents of each solution, catalog number and concentrations appear in this SOP. The ampules are stored at approximately -10°C in the dark. Stock ampules are good for a period of one year. If the stock solution has a manufacturer's expiration date, that is used. If a date is not evident, it is assigned one year. This procedure is used for all "neat" standards.

Upon opening, all contents are transferred to 1.5 - 2.0 mL amber, Teflon-lined screw-capped vials. Opened stocks can be used for a period of three months. Listed are compounds in Method 8260 and includes those done on a regular basis. Other standards, if needed, are either purchased as solutions or neat standards from Supelco, Chem Service or other certified supplier.

5.3.1 Stock Standards

Each stock calibration mix is transferred to a 1.5 - 2.0 mL amber Teflon-lined screw-capped vial just prior to use. Each transfer is recorded in LabNet system and each standard is assigned an SRN. The standards are prepared as follows. The following tables are used as guidelines.

5.3.1.1 Main Mixes

Waters

Stock Compound/Mix	Volume (mL)	Vol. (MeOH)	Conc.
2000 ppm 502.2 CAL2000 MegaMix™	100	diluted to 2 mLs	100 ppm each component

5.3.1.2 Extra Compounds

Waters

Stock Compound/Mix	Volume (uL)	Vol. (MeOH)	Conc.
2000 ppm Volatile VA Mix 1000 ppm CEVE 5000 ppm Carbon Disulfide 5000 ppm Vinyl Acetate	50 100 20 20	Diluted to 1 mL	100 ppm each component

Stock Compound/Mix	Volume (uL)	Vol. (MeOH)	Conc.
2000 ppm Tetrahydrofuran 2000 ppm MTBE 1000 ppm Chlorohexane	500 50 100	Diluted to 1 mLs	100 ppm MTBE/Chlorohexane 1000 ppm THF

5.3.1.3 Gases

Waters

Mix	Volume (uL)	Vol. (MeOH)	Conc.
1000 ppm Gas Mix	25	Diluted to 1 mL	25 ng/uL

5.3.1.4 Main Mixes

Soils

Stock Compound/Mix	Volume (uL)	Vol. (MeOH)	Conc.
2000 ppm 502.2 CAL2000 MegaMix™	100	diluted to 2 mLs	100 ppm each component

5.3.1.5 Extra Compounds

Soils

Stock Compound/Mix[1]	Volume (uL)	Vol. (MeOH)	Conc.
2000 ppm Volatile VA Mix 1000 ppm CVE 5000 ppm Carbon Disulfide 5000 ppm Vinyl Acetate	50 100 20 20	Diluted to 1 mL	100 ppm each component
2000 ppm Tetrahydrofuran 2000 ppm MTBE 1000 ppm Chlorohexane	50 50 100	Diluted to 1 mL	100 ppm each component

5.3.1.6 Gases

Soils

Mix	Volume (uL)	Vol. (MeOH)	Conc.
1000 ppm Gas Mix	100	Diluted to 1 mL	100 ppm

5.3.1.7 Appendix IX (either matrix)

Mix	Volume (uL)	Vol. (MeOH)	Conc.
2000 ppm Appendix IX 5000 ppm Iodomethane 20,000 ppm Isobutanol	250 100 1000	Diluted to 2 mLs	10,000 ppm Isobutanol 250 ppm

5.3.1.8 Low Level Standard

A low level standard is prepared by making a 1/10 dilution of the stock standards of each of the above (nitriles and acrolein included). This standard is used to prepare the low points in the initial calibration. The low level standard may contain all the Main Mixes, gases, nitriles and acrolein., and any other required standard. A low level standard for the Appendix IX compounds is also prepared separately due to duplication of some compounds.

A low level surrogate solutions is also prepared by a 1/10 dilution of the working for low points in the water curve. The calibration levels may vary with the compounds. See recipes in the calibration section for the levels. The low point in the calibrations are based on each compounds reporting limit.

All solutions are stored in a 1.5 - 2.0 mLs amber Teflon-lined screw-capped vials at -10°C in the dark. All standard preparation is recorded in the LabNet system. Solutions are prepared every two weeks (1 week for the gases; 1 month for the nitriles).

Purgeable Standard Mixes/Neat Materials
Calibration Standards

502.2 CAL2000 MegMix™ Mixture

Benzene	2,2-Dichloropropane
Bromobenzene	1,1-Dichloropropene
Bromochloromethane	cis-1,3-Dichloropropene
Bromodichloromethane	trans-1,2-Dichloropropene
Bromoform	Ethylbenzene
n-Butylbenzene	Hexachlorobutadiene
sec-Butylbenzene	Isopropylbenzene
tert-Butylbenzene	p-Isopropyltoluene
Carbon Tetrachloride	Methylene chloride
Chlorobenzene	Naphthalene
Chloroform	n-Propylbenzene
2-Chlorotoluene	Styrene
4-Chlorotoluene	1,1,1,2-Tetrachloroethane
Dibromochloromethane	1,1,2,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane	Tetrachloroethene
1,2-Dibromoethane	Toluene
Dibromomethane	1,2,3-Trichloropropane
1,2-Dichlorobenzene	1,2,4-Trichlorobenzene
1,3-Dichlorobenzene	1,1,1-Trichloroethane
1,4-Dichlorobenzene	1,1,2-Trichloroethane
1,1-Dichloroethane	Trichloroethene
1,2-Dichloroethane	1,2,3-Trichloropropane
1,1-Dichloroethene	1,2,4-Trimethylbenzene
cis-1,2-Dichloroethene	1,3,5-Trimethylbenzene
trans-1,2-Dichloroethene	m-Xylene
1,2-Dichloropropane	o-Xylene
1,3-Dichloropropane	p-Xylene

2000 ug/mL each in P&T Methanol, 1 mL/ampule

502.2 Calibration mix #1

Bromomethane	Dichlorodifluoromethane
Chloroethane	Trichlorofluoromethane
Chloromethane	Vinyl Chloride

2000 ug/mL each in P&T Methanol, 1 mL/ampule

THF AccuStandard S-457
2000 ug/mL

MTBE AccuStandard S-078
2000 ug/mL

MLS Surrogate #Q1299ATP 25 ug/mL
4-Bromofluorobenzene
1,2-Dichloroethane-d4
Toluene-d8

MLS Matrix Spike #Q1299BFP 25 ug/mL

Benzene	Trichloroethene
Chlorobenzene	Toluene
1,1-Dichloroethene	

Purgeable Standard Mixes/Neat Materials
Accustandard-Lab Control Sample / Matrix Spike Standards
********or as indicated********

Liquids (53 components, does not include Bromochloromethane)
Catalog No. M-502A-R2-10X-PAK
2000 ug/mL

Benzene	1,1-Dichloropropene
Bromobenzene	cis-1,3-Dichloropropene
Bromodichloromethane	trans-1,3-Dichloropropene
Bromoform	Ethylbenzene
n-Butylbenzene	Hexachlorobutadiene
sec-Butylbenzene	Isopropylbenzene
tert-Butylbenzene	p-Isopropyltoluene
Carbon Tetrachloride	Methylene Chloride
Chlorobenzene	Naphthalene
Chloroform	n-Propylbenzene
2-Chlorotoluene	Styrene
4-Chlorotoluene	1,1,1,2-Tetrachloroethane
Dibromochloromethane	1,1,2,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane	
Tetrachloroethene	
1,2-Dibromoethane	Toluene
Dibromomethane	1,2,3-Trichlorobenzene
1,2-Dichlorobenzene	1,2,4-Trichlorobenzene
1,3-Dichlorobenzene	1,1,1-Trichloroethane
1,4-Dichlorobenzene	1,1,2-Trichloroethane
1,1-Dichloroethane	Trichloroethene
1,2-Dichloroethane	1,2,3-Trichloropropane
1,1-Dichloroethene	1,2,4-Trimethylbenzene
cis-1,2-Dichloroethene	
1,3,5-Trimethylbenzene	
trans-1,2-Dichloroethene	o-xylene
1,2-Dichloropropane	m-xylene
1,3-Dichloropropane	p-xylene
2,2-Dichloropropane	

Gases (6 components)
Catalog No. M-502B-10X-PAK 2000 ug/mL

Bromomethane	Dichlorodifluoromethane
Chloroethane	Trichlorofluoromethane
Chloromethane	Vinyl Chloride

Method 8260 Additional Appendix IX
Catalog No. M-8260-ADD-10X 2000 ug/mL

Acetone	2-Hexanone
2-Butanone	Iodomethane
Carbon Disulfide	4-Methyl-2-Pentanone
2-Chloro-ethyl vinyl ether	Vinyl Acetate

Bromochloromethane 2000 ug/mL
Catalog No. M-502-03-10X

MTBE Supelco 4-8483
2000 ug/mL

THF Aldrich 27,038,5 (Neat)
Stock made 200 mg/10 mLs MeOH (20,000 ug/mL)

5.4 Stock Matrix Spike Solution

The matrix spike compounds are obtained as solutions from a second source (i.e., Accustandard) in 1.5-2.0 mL ampules. These are listed on page 13. Matrix spike solutions are usually prepared by a different analyst than the one who prepared the calibration solutions. These are stored at approximately -10 C in the dark prior to use. Neat standards are kept for a period of one year un-opened or the manufacturer's expiration date. Once opened, the stock may be used for 3 months.

The matrix spike solutions are prepared as follows :

Compound	Volume[1] (uL)	Volume (MeOH)	Concentration
Liquids (2000 ppm) 8260 Additional (2000 ppm)	25 25	Diluted to 1 mL	50 ppm
Bromochloromethane (2000 ppm)	25	Diluted to 1 mL	50 ppm
Gases (2000 ppm)	25	Diluted to 1 mL	50 ppm
MTBE (2000 ppm)	25	Diluted to 1 mL	50 ppm
THF (20,000 ppm)	5	Diluted to 1 mL	100 ppm

For waters, addition of 5 uL of each solution results in all spike compounds at 10 ppb, with the exception of THF which is at 20 ppb.

For soils, addition of 5 uL of each solution, except THF at addition of 2.5uL, results in all compounds at 50 ppb.

These solutions are stored at approximately -10°C in several 1.5 -2.0 mL amber Teflon-lined screw-capped vials. All standard preparation is recorded in the LabNet system. Working matrix spike solutions have a 2 week/1 week expiration date or until low recoveries of the matrix spike compounds indicate a new solution is needed. See above for label information.

5.4.1 Stock BFB Solution

The BFB standard is purchased as a neat solution from Supelco.

Compound	Catalog No.	Concentration
Bromofluorobenzene	4-8083M	2000 ppm

The standard is stored at approximately -10°C in the dark and kept for a period of 1 year until opening. Upon opening, the solution is transferred to a 1.5 - 2.0 mL vial and assigned an SRN. Once opened, it can be used for 6 months.

Stock	Amount	MeOH (mL)	Concentration
BFB	25 mL	diluted to 2 mLs	25 ppm

Addition of 2 mL/5 mLs results in a concentration of 50 ng/5 mLs.
All preparation is recorded in the LabNet system. All labels are completed as above. The Working BFB Solutions are kept for a period of 6 months.

NOTE: Intermediate and Working Solutions are never assigned an expiration date exceeding the expiration date of the neat/stock standards/solutions.

5.5 Reagents

5.5.1 Reagent Water

One (1) liter of water is continuously purged with pre-purified nitrogen. The reagent water is routinely demonstrated to be interference-free. All compounds are less than their EQL.

5.5.2 Methanol

Purge and Trap B&J Methanol interference-free. Each lot number of methanol is checked for contamination prior to laboratory use and is documented in the Methanol Lot Number Blank Check logbook in the GC/MS VOA department.

6.0 CALIBRATION

Before an instrument is used as a measuring device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration is documented.

6.1 Description of Initial Calibration

An initial calibration may be completed:

- as needed-continuing calibration can not be met
- after a source cleaning and/or column change or any time a major repair or change has occurred with the instrument that affects calibration where a new calibration is indicated.

Confirm that the GC/MSD or bench-top is stable and equilibrated. If at all possible, allow the instrument to equilibrate overnight at all operating temperatures if the source/column has been cleaned/changed. Prior to beginning initial calibration it is a good idea to:

- check the background of air/water levels and base ion by scanning for appropriate ions and also visually inspecting the spectrum scan for any other possible and undesirable background.
- recheck the multiplier settings, after a source is cleaned the EM can most often be dropped.

6.2 PFTBA Autotune or Manual Tune

The instrument is first tuned in one of two ways: autotune or manual tune. The ion abundances in the calibration gas are best monitored near the temperature of analysis of BFB. Monitoring at this temperature produces the most representative cal gas scan and therefore the best estimate of BFB response.

6.2.1 If an AUTOTUNE is to be done, continue below. If not, skip to step 9.2.4. An autotune is not run before every initial calibration. If the instrument has been down for any reason previously listed or major difficulties in manual tune are encountered, an autotune is performed. Autotunes are generally NOT performed when an existing initial calibration is being met.

6.2.2 The Enviroquant software has a menu driven tune program. Begin the autotune program. Key masses are 69, 219 and 502.

6.2.3 Follow instructions and retrieve a hardcopy of the autotune results. Check the following:

- passed/fail: in itself, not necessarily an indication of MS performance
- repeller and ion focus settings
- electron multiplier voltage

The repeller and EM voltages are good indicators of the sources' cleanliness. Generally, the lower the setting the cleaner the source. Other factors may however, supersede (i.e. the age of the multiplier) and a clean source will not always autotune these low. The EM is set by autotune program to produce a target abundance for mass 69 (varies depending on the tune program and instrument). The operator may plan on having to increase this by 100-200 to achieve normal analysis sensitivity (depends on the tune program and the instrument).

Observe peak shape, absence of lead-ons/tailing, the resolution between isotopes, peak width and mass axis. A hardcopy of the profile scan is desirable, and can be filed with the autotune results.

6.2.4 If an AUTOTUNE has just been performed, continue here. If not, skip to step 6.2.7. Enter MANUAL TUNE and read the autotune (which was automatically stored in a file). For volatiles, edit the scan parameters to monitor ions 69, 131 and 219.

6.2.5 Enter one of several methods available and adjust the parameters (usually the ion focus, entrance lens and amu gain) to achieve the following relative abundances:

Mass	Relative Abundance
69	100%
131	32-40%
219	35-45%

These will vary with the MS. Mass 219 is usually 5-9% greater than mass 131. If necessary, adjust the amu gain for peak shape and high-end isotope resolution. An overall peak-width of 0.500 is desirable.

Again, these adjustments and relative abundances may not guarantee that BFB will meet requirements, but is a good place to start.

6.2.6 Hardcopy the profile scan. This should be filed with the autotune results. This file can serve as a diagnostic tool and can also provide a starting point in the event the operator has trouble meeting the 5-point calibration.

Save the changes to the appropriate Tune File. Exit the program.

6.2.7 If an AUTOTUNE has not been performed, enter MANUAL TUNE and adjust any parameters, if need be. Adjustment may not be necessary, and not desirable, if problems in tuning or meeting the initial calibration have not been encountered. Hardcopy a profile scan and exit.

6.3 BFB Analysis

Once the instrument is tuned, a 50 ng/5 mLs injection of 4-Bromofluorobenzene must meet criteria. The BFB can be purged or directly injected. The mass spectrum must meet the following criteria:

Mass	Ion Abundance
50	15-40% of mass 95
75	30-60% of mass 95
95	Base Peak, 100% rel. abund.
96	5 - 9% of mass 95
173	<2% of mass 174
174	>50% of mass 95

Mass	Ion Abundance
175	5 - 9% of mass 174
176	>95% but <101% of mass 174
177	5 - 9% of mass 176

The BFB is analyzed by one of the methods in Attachment 1. **(Method parameters listed in the appendices are examples only. This statement applies to all references made to these methods).** Typical Tekmar conditions also appear in Attachment 1. The EM voltage may be 100-200 volts above autotune. The abundances of the designated masses above MUST meet the criteria before analyses can begin. If necessary, enter MANUAL TUNE and adjust parameters. The instrument is tuned about every 12 hours of analysis.

6.4 Initial Calibration

Each calibration standard is analyzed according to one of the methods in Attachment 1. These are examples. The actual number of points in the calibration is determined by the calibration and acceptance criteria table (Attachment 4). The EM voltage may be 100-200 volts above autotune.

Allow standards to come to ambient temperature.

Fill six 5 mL or 25 mL (must be loaded separately) luer-lock gas-tight syringes with reagent water to overflowing. Replace the plunger and invert. Adjust to 5 mLs (or 25 mLs), confirming the absence of any air bubbles. Pull back slightly on the plunger to allow addition of standards. Use the following as guides :

Waters: 25-mL Purge Volume

Conc. Level[1]						Recipe (uL)				
Main Mix/Gas/ MTBE/Other	Extra	THF	Nit	Acrol	APIX	Main Mix/Gas/ MTBE/THF/ Other (100 ppm)	Extra (100 ppm)	Nit/Acrol (800/4000 ppm)	APIX SSS (250 ppm)	
0.5	NA	5	NA	NA	NA	2.5 (LL)	NA	NA	NA	2.5 L
1	2	10	32	160	2	5 (LL)	5 (LL)	1	2(LL)	5 L
5	5	50	80	400	10	12.5 (LL)	12.5 (LL)	2.5	1	2.5
10	10	100	160	800	20	2.5	2.5	5	2	5
20	20	200	240	1200	40	5	5	7.5	4	10
40	40	400	320	1600	60	10	10	10	6	20

[1] Stocks referred to here are listed on pages 11 thru 12, and include the regular compounds, Gas, Extra compounds, Appendix IX, Nitriles and Acrolein. Appendix IX curve is separate.

Soils: 5-mL Purge Volume

Conc. Level[1]						Recipe (uL)				
Main Mix/Gas/ MTBE/Other	Extra	THF	Nit	Acrol	APIX	Main Mix/Gas/ MTBE/THF/ Other (100 ppm)	Extra (100 ppm)	Nit/Acrol (800/4000 ppm)	APIX (250 ppm)	SSS
5	5	5	40	200	10	2.5 (LL)	==========>		2 (LL)	0.5
20	20	20	160	800	40	10 (LL)	==========>		4 (LL)	2
50	50	50	400	10	100	2.5	==========>		2	5
100	100	100	800	20	200	5	==========>		4	10
150	150	150	1200	40	300	7.5	==========>		6	15
200	200	200	1600	60	400	10	==========>		8	20

[1] Stocks referred to here are listed on pages 11 thru 12, and include the regular compounds, Gas, Extra compounds, Appendix IX, Nitriles and Acrolein. The Appendix IX curve must be analyzed separately.

For 5035 low-level preserved samples, all standards, blanks and LCSs will be prepared in 5 mL of the preservative solution (sodium bisulfate).

5035 Soils: 5-mL Purge Low-Level Preserved

Conc. Level[1]						Recipe (uL)				
Main Mix/Gas/ MTBE/Other	Extra	THF	Nit	Acrol	APIX	Main Mix/Gas/ MTBE/THF/ Other (100 ppm)	Extra (100 ppm)	Nit/Acrol (800/4000 ppm)	APIX (250 ppm)	SSS
5	5	5	40	200	10	2.5 (LL)	==========>		2 (LL)	0.5
20	20	20	160	800	40	10 (LL)	==========>		4 (LL)	2
50	50	50	400	10	100	2.5	==========>		2	5
100	100	100	800	20	200	5	==========>		4	10
150	150	150	1200	40	300	7.5	==========>		6	15
200	200	200	1600	60	400	10	==========>		8	20

[1] Stocks referred to here are listed on pages 11 thru 12, and include the regular compounds, Gas, Extra compounds, Appendix IX, Nitriles and Acrolein. The Appendix IX curve must be analyzed separately.

The same tables appear in the standard section. Immediately add the standards to a clean and baked purge vessel. Following the parameters in Table 1, analyze the 50 ppb standard (soil samples) or the 10 ppb standard (water samples). A normal standard will appear very similar to the ones in Figures 1 and 2. Quantitate the standard against the appropriate method file. A short list example of one file appears in Attachment 2. Sufficient areas for the first internal standard will vary somewhat between instruments. Acceptable areas should be based on maintaining sufficient sensitivity for poor responders without saturating the detector at the upper end of the calibration range. Too low an area will almost guarantee poor/unsatisfactory responses of low-response compounds and too high an area will result in saturation of some compounds at higher levels, resulting in false low response factors at high concentrations.

It is helpful to analyze a medium level standard first and assess the areas before continuing with the low/high level standards.

Response factors are calculated by the data system as follows:

$$RF = \frac{A_x \times Q_s}{A_s \times Q_x}$$

Where:
A_x = ion abundance for analyte
A_s = ion abundance for its internal standard
Q_s = concentration of its internal standard
Q_x = concentration of analyte
(Response Factors have no units)

The appropriate quant ion must be in the method file. See an example of a file in Attachment 2. A listing of the target compounds with their appropriate internal standards also appears in Attachment 2. Confirm the presence of all targets and the separation of non- co-eluting compounds. Note the response factors for the gasses. If necessary, prepare new standards.

If adjustments to the acquisition parameters are necessary, make them and re-analyze the 50 ppb standard (soil samples) or the 10 ppb standard (water samples).

When a standard is analyzed and processed on target as part of the initial calibration the RF's are automatically updated in the daily method. After all initial calibration standards are processed, checked and confirmed as being accurate and passing method criteria, the initial calibration is saved to the source method. This ensures that the correct initial calibration is used for each ensuing continuing calibration check. A hardcopy of the calibration report is generated. All method criteria are assessed for compliance. Confirm that 1) all CCC's are below 30% and 2) the RF's for all SPCC compounds are >0.300 (Minimum RF for Chloromethane, Bromoform and 1,1-Dichloroethane is 0.100).

Calibration curves are evaluated following the "Evaluation and Acceptance Criteria" table (Attachment 4). For all compounds in the initial calibration with a %RSD > 15.0%, calibration curves of area ratio versus concentration using a first or higher order regression curve of the calibration curve points will be performed.

Method 8000B/8260B specifies a minimum coefficient of determination of 0.990. (Method 8260A does not specify a minimum COD). The methods also specify a minimum of 5 calibration points for a linear model and a minimum of 6 calibration points for a higher order regression. The laboratory, in order to meet AFCEE requirements, will analyze a minimum number of points to satisfy both the new SW846 and AFCEE. All efforts will be made to meet the minimum COD of 0.990. However, there are some

compounds that historically present a problem meeting this requirement. These compounds are usually those listed in the analyte table of Method 8260B with qualifying remarks. Many of these have various known (or unknown) issues that would effect reproducibility (i.e., Acetone qualifier pp = poor purger). These typically include many of the Appendix IX compounds as well. The laboratory will take minimal action for these compounds.

The recipes noted above will be modified to include the necessary calibration levels. Recipes are for guidance only and may change as needed.

An example of an acceptable initial calibration appears in Attachment 2. The BFB tune, and all standard raw data are kept near the instrument if current, otherwise can be found in a file. Each instrument has its own initial calibration.

NOTE: The actual number of points in the calibration and the low point in the calibration may vary with client and project need. Clients may have additional requirements, which would be covered in a client-specific QAP.

6.5 Daily or Continuing Calibration

Continuing calibration occurs prior to analysis.

If time remains after the initial calibration, and the 50 ppb standard (soil samples) or the 10 ppb standard (water samples) meets continuing calibration criteria, samples can be analyzed up to the 12 hour tune limit. The samples are quantitated against the average RF or appropriate as per method. See later sections describing calculations.

After having satisfied BFB tune requirements, a continuing calibration standard must be analyzed. Analyze a 50 ppb (soil samples) or 10 ppb (water samples) standard following the procedure outlined above. Confirm (CBCHK or Form 7) that all CCC's are <20% Drift and the RF's for all SPCC's are >0.300 (Minimum RF for Chloromethane, Bromoform and 1,1-Dichloroethane is 0.100) . If so, the continuing calibration is acceptable and analysis can begin.

The raw data for the tune, a copy of the initial calibration table, a copy of the continuing calibration check and the continuing calibration standard raw data are kept in a folder for that 12 hour tune.

If continuing calibration can not be met, either new standards and/or a new calibration is needed.

NOTE: Method 8260A and 8260B stipulate that if the CCC's are not part of the analyte list then all compounds being reported must be < 20% drift.

All internal standard areas and retention times are assessed immediately after calibration. Areas and times are recorded in the appropriate instrument log-book and a comparison to the previous days calibration. Internal standard areas should not deviate by a factor of two or the retention times should not deviate by > 30 s. If the situation occurs, appropriate action is taken and the standard re-analyzed. All corrective action and return to control are documented in the CAR logbook for the appropriate instrument.

7.0 PROCEDURE

7.1 Quality Control Checks

Quality Control is accomplished through 1) daily tuning and calibration checks and 2) preparation QC traceable through individual batches.

7.1.1 Initial Calibration

PFTBA BFB TUNE	Prior to Initial Cal	*limits in Section 6.3
200 or 40 ng \ 150 or 20 ng | 100 or 10 ng | 50 or 5 ng | 20 or 1 ng / 5 or 0.5 ng	Initial Cal need dependent on situation.	*limits in Section 6.4

NOTE: As stated, the actual number of points in the calibration and the low point in the calibration may vary with client and project need. Minimum number of points for 8260A will be 6 (six). Minimum number of points for AFCEE and/or 3rd Edition SW846 may be 8 (eight) or 9 (nine) depending on matrix. Other clients may have additional requirements, which would be covered in a client-specific QAP.

7.1.2 Method Blank (MB)

Prior to any analysis, the reagent water must be shown to be free of interference's and target compounds.

A 5 mL or 25 mL portion of reagent water, or 5 mL of preservative solution (5035), is analyzed using one of the methods in Attachment 1. All target compounds must be less than the quantitation limit (See Section 2.0).

Once the MB analysis is complete and acceptable, analysis can proceed.

7.1.3 Daily Analysis

PFTBA BFB	Prior to continuing	* see above calibration
Daily Calibration Standard Samples *	Prior to samples	* see Section 6.5

*Any given 12 hour period contains a tune, standard, blank and LCS. Preparation QC is at a 5% frequency. Instrumental controls are outlined above and further discussed in the procedure section.

Prep QC	Frequency
MB	Prior to analysis
LCS	1 set per analysis batch (see below *)
MS/MSD's[1]	at least 1 set in 20
Surrogates	every blank, sample and QC Sample
QC Charting	LCS/LCD set per frequency to satisfy charting requirements.

[1] The sample selection for MS/MSD is rotated among client samples so that various matrix problems may be noted and/or addressed.

7.2 Sample Preservation and Storage

Sample containers, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance and/or specific contract or client requests. Listed below are the holding times and the references that include container and preservation requirements for compliance with the Clean Water Act (CWA) and the Resource Conservation and Recovery Act (RCRA).

Matrix	SW-846
All	14 days (VTS)

VTS = verified time of sampling

All samples received for volatile analysis are refrigerated upon receipt at 4 ± 2°C. Refrigeration is the only preservative for soil samples, while water samples are additionally preserved with 3 drops of 36% HCl. Samples marked un-preserved are analyzed within 7 days of collection.

7.3 Sample Preparation / Analysis

7.3.1 Waters

Allow samples and standards to come to ambient temperature.

Remove the plunger from a 25 mL luer-lock gas-tight syringe and fill to near over-flowing. Replace the plunger. The pH of all samples is verified at time of analysis. If < 2, a check-mark is placed in the appropriate column in the logbook. If > 2, the actual estimated pH is written in the same column. pH checks and verification of hold-times are documented on the review form. Samples lacking preservation may be noted in the case narrative. Invert the syringe, and adjust the volume to 25 mLs. Confirm the absence of all air bubbles.

Draw back slightly on the plunger. Add 5 mL of the working ISS/SSS solutions. Immediately add the sample to a clean purge vessel. Using the methods described in Attachment 1 analyze the sample.

If a batch is going to be analyzed, which is usually the case, load all samples following the procedure above. After the batch is loaded, replace all samples and standards back in storage.

If a dilution is required the following guidelines are followed. If the dilution is > 1/100 (250 uL of sample) an initial dilution is made into a volumetric flask. If serial dilutions are required, no less than 1 mL is taken for further dilutions. The final sample aliquot taken for analysis from the volumetric is no less than 250 uL. If the dilution is < 1/100, the appropriate sample amount is added directly to the 25 mL syringe. In either case, ISS and SSS are added to the 25 mL syringe.

Using those parameters listed in Attachment 1, analyze all samples. After analysis, remove the purge vessel from the Tekmar, rinse the purge line and vessel, and place the vessel in the oven to bake at 100°C for at least an hour.

Opened sample vials are used only once unless: 1) any necessary dilutions/reruns are done the same day or 2) there are no other vials for that sample.

7.3.2 Soils

As many clients still request method 5030 at the present time, soils are still being analyzed as indicated below. As clients convert to Method 5035, this section will be removed.

Before weighing any samples, check the balance using the appropriate class weights. Record the actual weights in the Balance Logbook. If a problem is noted, contact quality control.

Allow samples and standards to come to ambient temperature.

Weight out 5 grams of the sample into a clean previously baked purge vessel. Record the weight to 0.1 g. Place the vessel on the Tekmar. Add reagent water to overflowing to a 5 mL syringe. Replace the plunger, invert the syringe, and with tapping, adjust to 5 mLs. Confirm there are no air bubbles. Add 5 mL of the working ISS/SSS solutions. Transfer the contents to the purge vessel. Using the methods described in Attachment 1, analyze the sample. All soil samples are analyzed with a heated purge (40°C).

If a batch of samples is to be analyzed, prepare each as above. After the batch is loaded, replace all samples and standards in storage.

For blanks and LCS samples associated with soil analyses, 5 grams of pre-heated sand is weighed into a purge vessel.

Any sample that contains targets above the calibration range is diluted to accurately quantitate those compounds. Any sample that, based on historical data has shown to contain high concentrations of compounds is analyzed at an initial dilution. Any sample screening high, is analyzed at an initial dilution (a portable Organic Vapor Monitor is used to help the analysts screen the samples). If an initial analysis over-diluted the given sample it is re-analyzed as a low level soil. If the low-level analysis contains compounds above the calibration range, and the same compounds are within range in the dilution, both sets of data may be reported to the client.

If a 1/2 or 1/5 dilution is required, 2.5g/1.0g of sample is weighed into the purge vessel.

7.3.2.1 Medium-Level Soil Extracts

If a larger dilution is required, a medium-level soil extract is prepared as follows. Five grams of sample is weighed into a tarred vial. Five (5) mLs of methanol is added to the vial and the vial sealed. A portion of the extract (100 uL maximum) is taken for analysis. Internal standard and surrogate solutions are added to the 5 mL syringe. Serial dilutions, if needed, are made from the extract and appropriate amounts taken for analysis. A portion is also removed and stored in a 1-1.5 mL Teflon-lined screw-capped vial for storage.

If the sample upon which a medium-level prep as been performed also required an MS/MSD, the appropriate amount of MS solution is also added.

All samples prepared in this manner will be analyzed against a medium-level soil curve. This standards, blanks and LCS samples will contain 100 uL of methanol. The curve will be at ambient temperature.

NOTE: Some soils are analyzed initially at low levels due to increasing client requests for lower reporting limits. The same samples may then require large dilutions to bring compounds into the calibration range of the instrument. Some compounds, most notably the ketones, have very different responses when heated versus non-heated, despite the sample matrix. Traditionally, the lab heats soils. Therefore, the match between original analyses and dilutions for compounds such as these may not appear to correlate.

Dilution	Sample Weight	Vol. MeOH (1/2.5) Extract
1/2	2.5 grams	---
1/5	1.0 grams	---
1/50	5 grams / 5 mLs	100 uL
1/250	5 grams / 5mLs	20 uL
1/500	5 grams / 5 mLs	10 uL

Using those parameters in Attachment 1, analyze all samples in the batch. After analysis, remove the purge vessels from the Tekmar, dispose of the contents, rinse the purge line and vessel, and place the vessel in the oven to bake at 100°C for at least one hour.

Sample vials/jars are only used once unless: 1) any dilutions/reruns are analyzed the same day or 2) there is only one jar for analysis.

For each new lot number of methanol used, 100 uL is added to 5 mLs of OFW (organic free water) and analyzed. Absence of target compounds is verified and recorded in the MeOH Lot Check Logbook.

7.3.2.2 Method 5035

NOTE: ICAL Standards are prepared with 5 mL milli-Q.

Samples for low level VOA soil analysis may be received at the lab in one of two manners: First, as replicate 5 gram core samples in 40 mL vials containing a Sodium Bisulfate preservative solution. See appropriate SOP's for collection, preservation. Alternatively, unpreserved 5 gram core samples may be received is Encore containers. These core samples must be placed in the bisulfate preservative solution within 48 hours of collection. This time requirement is currently under review by appropriate regulatory agencies and may be extended beyond the 48 hours. Until such time, the laboratory will endeavor to "fix" the sample cores in preservative within 48 hours of collection. The laboratory may receive replicate 5 gram soil cores to be used for reanalysis if needed.

In addition to low level samples, an additional soil aliquot should be received for use as a screen and possible use as a mid-level extraction/analysis. This additional core must also be fixed in methanol within 48 hours of collection. The amount of methanol added must closely correspond to a soil to solvent ration of 1:1. Though not specified in the method, STL will pursue a goal of removing the methanol from the soil within 48-72 hours after the initial extraction. A portion of the methanol be removed and placed in an amber 1.5 - 2.0 mL Teflon-lined screw-capped vial for storage. This time limit should standardize the amount of time the methanol comes in contact with the sample.

Methanol extracts of soils will be analyzed as stated above at ambient-temperature against a medium-level soil initial calibration. All surrogate and internal standard solutions will be added at time of analysis.

Low level soils will be analyzed using the Archon Closed Purge and Trap Auto Sampler System. Surrogate and internal standard solutions will be added automatically by the instrument, thereby, maintaining the integrity of the sample. Initial concentrations of both surrogate and internal standard solutions shall be such that "sample concentrations" of the analytes conform to the method and the spike and surrogate tables provided in this OP. The concentration of the solution and amounts spiked may vary depending on the precision obtained with a given solution/volume combination. However, the final concentrations of such compounds in the samples will follow the same guidelines as previously stated in this SOP for all other samples.

As with the internal standard and surrogate, all QC spike solutions must also be added to the closed sample container. This is accomplished by the addition of the spike solutions through the septum with a small gauge (10 uL) syringe just prior to the sample being placed on the instrument for analysis.

Some calcareous matrices may react with sodium bisulfate and cause effervescence. The method indicates that such samples need to be recollected without bisulfate preservative and analyzed within 48 hours of collection. Alternatively, some clients and/or regulatory agencies allow optional preservation and holding time criteria. On a per project basis, samples that react with sodium bisulfate may be collected and placed in vials containing water without the preservative. The vials are kept $\leq -12°C$ until analysis. Such samples must be thawed prior to analysis. The maximum holding time for this type of collection and preservation is 7-days from the collection date. This alternative approach must be approved by the client/project prior to use.

7.3.3 Drum/Waste Samples

- Non-methanol Miscible
- Methanol Miscible

These samples are normally treated as medium level soils or waste dilutions. Waste dilutions normally consist of 1 gram of sample diluted to 10 mLs of methanol. Serial dilutions, if needed, are made from this extract. A portion of the extract is then added to the 5 mL syringe containing surrogate and internal standard. The lab can pre-spike the surrogates and spike compounds if client-specified to do so. As most drum/waste samples result in very high dilutions, it has been the labs experience that surrogates and MSs are most often diluted out and provide no useful information. Unless, specifically assigned to do so, surrogate and matrix spiking will take place at time of analysis.

7.4 Preventive Maintenance

Instrumental maintenance can be categorized as daily and "as required".

7.4.1 Daily Maintenance

The most routinely performed maintenance includes:

- position rinse
- tube baking after sample analysis
- oven bake after high level samples

7.4.2 "As Required"

Most maintenance is done on an "as needed" basis, is operator determined and can be categorized as GC, Tekmar, or MS related.

7.4.2.1 GC Related

- change column; condition new column
- clean separator; change separator
- check helium flow rate
- change gas cylinders and moisture trap

7.4.2.2 MS Related

- clean source/rods and anything associated with that activity

7.4.2.3 Tekmar Related

- rinse positions
- change positions; change parts of positions
- change transfer line; clean transfer line
- replace trap; condition new trap
- refurbish Tekmar
- check purge pressure and flow rate
- analysis of position blanks after high-level samples

Each required maintenance may be performed for a variety of reasons. Certain trouble-flags will indicate what maintenance procedures may be required. A description of the situation, actions taken and follow-up must be completed. In addition, the entry number must be transferred to the appropriate instrument logbook on the day of maintenance, initialed and dated.

7.5 Documentation/Tracking of Sample Analyses

The preparation and analysis is recorded in the GC/MS Volatiles Logbook, and must be completed for each days analysis. An example of a logbook page appears in Attachment 3.

The GC/MS VOA lab employs several forms that serve both a tracking and review function. The Sample Tracking Sheet (BigBoard) is filled out for each sample # batch. It contains information the analyst needs as far method, QC requirements, special reporting requirements, etc...in addition for space to track the analysis of every single sample in the sample # batch and the outcome of that analysis.

The Tune Form is filled out for every 12 hour tune and contains several kinds of information. The forms main function is to track the analysis of all the samples analyzed during the 12 hours, initial review and data crunching documentation for the samples in the batch, tune and standard information etc...The Tune Form is not necessarily specific to a single sample # batch. The Tune Form is discussed again in the initial review section.

In addition, all samples logged into the department appear on a hold-time summary sheet (PANIC) where ALL samples in-house are listed by hold-times. This summary is utilized by the analysts when making decisions as to methods and analyses that are needed for the day. As samples are analyzed and reviewed, the summary sheet is constantly updated to reflect those samples completely analyzed, those requiring dilutions and re-analyses (essentially a posted summary of the Sample Tracking Sheets). At the beginning then of each day, the completed analyses are removed from the summary sheet and new samples are added. The Sample Tracking Sheet and Tune Form can be found in Attachment 3.

7.5.1 Archival of Data

Back-ups are scheduled to occur automatically through the ARCServe software. There are different types of back-ups.

1) The system have a differential back-up done Saturday through Thursday. This occur at 3:00AM each day. The differential tape must be in place by this time and is loaded the night before (usually). These tapes are over-written each week. Differential tapes are located at the terminal.

2) The system automatically back-up the archive database information, regardless of the tape that is in the drive. This is done in the un-likely event that ARCServe crashes and the database (the archive-logs) is deleted. Duration of this event is about three minutes and takes place immediately after the differential and full back-ups.

3) Every Friday the system perform a full-system back-up of data). A blank archive tape is required for each Friday back-up. Depending on the amount of data on the system, more than one tape may be necessary. Full tapes are never over-written. The most current full tapes are stored downin the office area. Older tapes are in locked storage.

The system maintains a database, or logs, of each back-up session. Successful completion of each back-up can be verified each morning by accessing the job report logs in ARCServe. This is done each morning. Any missed jobs can be re-scheduled and completed in the morning of the following day. As noted above, this database is re-archived after every normal back-up and can be retrieved at any time necessary.

7.5.2 Removal of Data

Although there is a substantial amount of space available to both BNA's and VOA's during busy periods the system can fill rather quickly. As an estimate, with a total of eight (8) instruments, a maximum of about 2-3 months (per instrument) can be kept on the system at one time. There is not necessarily a set definite schedule of removing data from the system. As per laboratory SOP's once the data package has been removed and all data associated from that batch has been reduced, reviewed, packaged and sent to report generation, the tune form is placed in designated location. Either by necessity or at the Unit Leaders discretion, these are compiled and the data then actually removed from the system..

8.0 QUALITY CONTROL

8.1 QC Summary

The department will review the quality controls as follows:

8.1.1 Method Blank / Laboratory Control Standard

At least one MB and LCS will be included in each laboratory batch. Regardless of the matrix being processed, the LCS and MBs will be in an aqueous media.

The MBs will be examined to determine if contamination is being introduced in the laboratory. The LCS will be examined to determine accuracy and precision.

8.1.2 Accuracy

Accuracy will be measured by the percent recovery (%R) of the LCS. Both 8260A and 8260B list or suggest (8260B) accuracy limits for an initial demonstration of precision and accuracy. There are no further guidelines for spike recoveries. The current limits for the suggested spike compounds listed in the methods are listed in Attachment 2 of this SOP. Internally, QA/QC will monitor %R, and will plot control charts to monitor method accuracy and generate control limits when deemed necessary. The number of compounds being used for bench level control and the accuracy limits assigned to those compounds may vary with client, QAP, project etc.. This information is transmitted to the bench via the COC, kick-off meetings, tech profiles etc...and indicated on one of the forms used at the bench. The accuracy limits are also posted on controlled boards in both the analytical and data areas (includes both method/sop limits and in-house generated limits. In-house generated limits are subject to change, but are included in Table 1).

8.1.3 Precision

Precision will be measured by the reproducibility of the LCS/LCD and will be calculated as Relative Percent Difference (RPD). The Methods list guidelines for the initial demo as noted above, but give no further guidelines for spike data. Current limits are listed in Table 1, however, RPD's are not used to assess bench level CA prior to sample analysis. Internally, QA/QC will monitor precision and calculate limits and log in LCS and LCD's at the appropriate time, at which both will be analyzed. Otherwise, only one LCS will be completed.

8.1.4 Surrogates

Surrogate Compounds will be added to every sample to measure performance of the analysis. Results must agree within statistical control limits in order to be considered acceptable. Limits are listed in Table 1. In-house surrogate limits are also generated as per method. As with LCS samples, the limits used to assess accuracy vary with client, QAP, project etc....and the information transmitted to the bench in the same manner.

8.1.5 QC Charting

Precision and accuracy are monitored using LCS / LCD data. In-house criteria have been generated and are in use at present. Additional data may be added at QA/QC discretion during the year. During that period of time, additional LCS and LCD's will be logged into the system until adequate data are generated. Spike levels are 50 ppb/10 ppb for soils/waters. Only those compounds listed above are spiked and should be representative of the whole. The more non-routine compounds are not part of the spiking solutions. Other limitations (availability of second source) may also prevent adding these to spiking solutions. See comments in Section 6 for application of in-house control limits.

8.2 Corrective Actions

Listed below are the steps to be taken when an out-of-control situation occurs. The analyst must address the following issues as described below in the individual sections.

- demonstrate that all of the problems creating the out-of-control situation were addressed;
- document the problem and the action that was taken to correct the problem;
- document that an in-control situation has been achieved; and
- receive approval (signature) of the unit leader, section manager, QC personnel or other qualified personnel prior to release of data associated with the problem.

As noted in Section 9.2.1, bound corrective action logs are located in each run-log. In addition, a separate CA form, specific to a unique sample # batch, is attached to the COC and sample tracking form when the samples are initially entered into the sample tracking documentation used by the department. The log-book and sample # are used to note all out-of-control events, the actions taken to try and correct the problem, the return to control and qualification of data is needed.

Discussed below are the suggested and required courses of action when an out-of-control situation has occurred.

8.2.1 Surrogates

All surrogate recoveries are calculated. If ANY surrogates are outside limits in the MB, it must be re-analyzed. Analyses CAN NOT proceed until an in-control situation is demonstrated. Re-analyze the blank. If surrogates are still out, the instrument may need to be re-tuned (BFB) and/or another calibration standard analyzed. If the problem persists, further maintenance action may be required (i.e. trap replacement, clean separator).

Before pursuing other measures, check to be sure that:

- calculations are correct
- concentrations of the surrogates in the spiking solution are correct
- the correct amount of ISS/SSS solution was added
- ISS/SSS areas are reasonable

If any surrogates in a sample are outside limits, check the above first. Any sample that has a surrogate out must be re-analyzed. The re-analysis can take the form of a dilution, if there is reasonable expectation that a high concentration of a target compound is causing a matrix effect. If the surrogate (s) is/are still outside limits a matrix effect is demonstrated and both reports are submitted. If all surrogates are in-control on the re-analysis, only the second analysis is reported.

Every effort is made to complete the re-analysis within hold-time. If this is impossible (i.e. capacity hold-times preclude re-analyses hold-time) both reports may be submitted. This is documented in the narrative.

If the sample with the out-of-control surrogates is the same sample on which the MS and MSD has been performed, and the pattern is duplicated, then re-analysis is NOT required. Documentation of the similarities is required.

Surrogate corrective action is documented on the Individual CA Sample # Report for samples, and in the CAR logbooks for blanks and LCS samples.

8.2.2 BFB Criteria

If BFB criteria can not be met, determine if the source of the problem is instrumental or tune related. Inspect overall sensitivity, possible excessive background, the proportionality of the masses, relative abundances of the target masses. If it seems tune related, adjust the tune parameters in Manual Tune slightly, until acceptance is achieved. If the problem seems instrumental, perform suggested trouble-shooting to locate and correct the problem (Suggestions can be found in most of the manuals). NO analysis can proceed until criteria are met. Corrective action for BFB analysis is documented in the CAR book associated with the instrument in question. Return to control must be documented.

8.2.3 Initial Calibration

If initial calibration can not be met, determine if the problem is analytical or instrumental. Some suggested questions to ask would be:

- were the standards prepared correctly?
- was the proper amount analyzed?
- check the chromatogram - did something happen on one or two analyses; i.e. a leak
- check the response factors - is one concentration level very high or low? re-analyze
- how old are the standards?

All calibration criteria must be met (refer to Section 6.4). If the ICAL does not meet specified criteria, at minimum, the appropriate levels must be re-analyzed. If necessary, new standards should be prepared and the levels re-analyzed. During analysis of an initial calibration, documentation of the re-analyses of specific levels is not required. See previous section outlining CA for minimum COD values as well.

8.2.4 Continuing Calibration

If continuing calibration can not be met, determine if the problem is analytical or instrumental. Some suggestions:

- check the chromatography
- is overall sensitivity low?
- excessive background?
- how old is the standard?
- need a new 5-point?
- has the tune shifted?

Compare the relative abundances of 69, 131 and 219 from that days manual tune to those on the day the initial calibration was analyzed. Slight adjustments to the tune may bring the standard in. Certain compounds will help indicate what the problem is.

All calibration criteria must be met (refer to Section 6.5). If the CCAL does not meet specified criteria, at minimum the standard should be re-analyzed. A new standard may be prepared and then re-analyzed. If necessary, a new ICAL must be run. All action taken for CCAL's must be recorded in the CAR logbook for that instrument. Return to control must be documented.

8.2.5 Method Blank (MB)

If the MB is/appears to be contaminated, re-analyze it on a different position. If contamination is still present, the problem may be in one of the common elements, such as the trap, transfer line, port valve or column. Baking the trap/column and running position blanks may be necessary. If contamination has occurred beyond that, and maintenance is required (i.e. replace trap) it is documented in the Maintenance Logbook. Corrective action and return to control for MBs is recorded in the CAR logbook for the appropriate instrument. Under extenuating circumstances, if analysis continues, qualification must be made as to the positive hits above the PQL for the compounds in question. Any associated samples analyzed in the tune must be noted. Any samples containing positive hits must be noted. IF, the samples containing positive hits can not be re-analyzed (ex. past hold-time), the positive hits are flagged with "B" and the situation and data noted and qualified in a case narrative.

8.2.6 Laboratory Control Sample (LCS)

As specified in Section 8.1.2, the number of compounds and the limits used to assess accuracy vary with client, QAP, project etc.....Both method/SOP and in-house generated limits are listed in the Appendices. The in-house limits are subject to change. The need and course of corrective action varies with the number of compounds being used for bench control and positive detected of compounds outside limits. The following guidelines are used :

(1) AFCEE : All compounds are used for bench control.

- If any compound exhibits low recoveries the LCS is re-analyzed. If the compound is still low a new spike may be prepared and the LCS re-analyzed. Analysis should not continue until the situation is taken care of. All corrective action is documented at the time and return to control demonstrated for low compounds. IF, in extenuating circumstances, analysis is continued, the low compounds must be noted in the CAR book, associated samples must be qualified in the qualification section, absence of CA documented etc.. Data must be qualified for those compounds in the narrative.

- If any compound exhibits high recoveries the LCS may be re-analyzed, and/or a new solution prepared, and/or a new standard prepared and calibrations repeated.

All corrective action is recorded at the time in the CAR logbook and return to control documented if applicable. AFCEE allows for high recoveries on a one time basis if the said compounds are not detected in the associated samples. Any high compounds must be noted in the CAR logbook, the associated samples listed in the qualification section, and the presence or absence of these compounds in the associated samples. If, positive detects are noted, and the samples are unable to be re-analyzed, the situation must be documented and noted in the case narrative. Following the first occurrence of high recoveries, the bench will take appropriate note and follow-up with appropriate CA within a reasonable amount of time.

(2) QAP's etc...specifying five compounds.

- ALL five compounds must be within limits for analysis to proceed. The LCS samples may be re-analyzed. New spike solutions may be prepared. Or new standards or CCAL's may be analyzed. All corrective action and return to control must be documented at the time in the CAR logbook of the appropriate instrument.

- The actual limits used for the five compounds may be QAP specific (usually those listed in the table in the appendix) or in-house generated by matrix and method. In either case, the above CA and required documentation apply.

- For all other compounds in the full-list spike, all recoveries are assessed, although no immediate corrective action may be required. If the recoveries are low, in general another LCS may be re-analyzed. The spike solution and standard may be verified for correct concentrations. However, no corrective action is absolutely required by the bench unless an error is discovered. The recoveries may or may not be documented in the narrative, however, they are noted on the review form. The recoveries of the "un-controlled" compounds may be used for data interpretation.

- Although not strictly required to take immediate corrective action, the purpose of the full-spike is two-fold in that the bench should use it as an indicator of the status of the calibration standards, instrument conditions etc...as well as a tool for data interpretation. Therefore, in keeping with good lab practice, the situation should be noted and assessed and any corrective action deemed necessary should be taken within a reasonable amount of time (Example: High recoveries on gases => new calibration standard may be needed).

8.2.7 Matrix Spikes (MS)

As specified, in section 8.1.1, the number of compounds and the limits used to assess accuracy vary with client, QAP, project etc.....Both method/SOP and in-house generated limits are listed in the Appendices. The in-house limits are subject to change. The need and course of corrective action varies with the number of compounds being used for bench control and recoveries of same compounds in the associated LCS samples. The following guidelines are used :

(1) AFCEE : All compounds are used for bench level control.

- If the MS exhibits recoveries outside limits, AFCEE requires it to be re-analyzed as the MSD. No further action is required. Documentation is required however, on the individual CAR form and association made to the LCS for those compounds and in the case narrative. See above specifications for associated LCS samples however.

(2) QAP's etc...specifying five compounds.

- ALL five compounds are assessed. If recoveries are outside limits, the LCS is reviewed for those compounds. If the recoveries are within limits in the associated LCS samples, no further action is required. See above section concerning LCS CA for further information and action required for recoveries outside limits in LCS samples.

- The actual limits used for the five compounds may be QAP specific (usually those listed in the table in the appendix) or in-house generated by matrix and method. In either case, the above CA and required documentation apply.

- For all other compounds in the full-list spike, all recoveries are assessed, although no immediate corrective action may be required. The affected compounds may be compared to the same compounds in the associated LCS samples. See the above section for further information and action required for these compounds in the LCS samples. The recoveries may or may not be documented in the narrative, however, they are noted on the review form. The recoveries of the "un-controlled" compounds may be used for data interpretation.

8.2.8 Internal Standard Policy

Method 8260 or Method 8260A do not require re-analyses of samples for low internal standard areas. However, it is CHI's policy to monitor areas and retention times, therefore, the following guidelines apply.

Situations requiring re-analyses :

- If ALL areas are outside limits the sample will be re-analyzed.
- Any sample that has a positive hit associated with any internal standard outside limits will be re-analyzed.
- If ANY surrogates are outside limits the sample will be re-analyzed.

Situations NOT requiring re-analyses :

- If all surrogates are within limits and there are no positive hits associated with those internal that are outside limits, the sample does not have to be re-analyzed. Situation should be addressed in the case narrative and noted on the sample CAR form.
- If all surrogates are within limits, but there is an obvious matrix effect occurring, even if positive hits are noted, the sample does not need to be re-analyzed. This decision will be approved by the unit leader or section manager. The situation must also be addressed on the sample CAR form and narrative.
- If there is historical evidence that shows a repeated pattern for a certain client and site, and this can be documented by reviewing past projects, the samples do not have to be re-analyzed. This decision will be approved by the unit leader or section manager.
- Internal standard areas for samples are documented on the Individual CAR form. Internal standard areas for CCAL to CCAL are documented in the appropriate CAR logbook.

Any sample showing retention times outside windows will be re-analyzed. This is documented in the appropriate manner as in the preceding paragraph.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 Computer Data Production/Reduction

The Target 3.5 software produces a Total Ion Chromatogram (TIC), header, quant report and background subtracted spectra. For those clients requiring it, a 5 tentatively identified compound search is also performed. The data system will produce an integration listing and tentative identification of each hit found at the selected percentage of the largest peak present.

9.1.1 Quantitation of Target Compounds

Quantitation of the target compounds is performed by the data system can be accomplished as follows:

WATERs: concentration (mg/L) = $\frac{[A_x \times I_s]}{[A_{is} \times RF]} \times DF$

Where:
A_x = area of characteristic ion for target
I_s = concentration of internal standard (ng)
A_{is} = area of characteristic ion for int. std.
RF = response factor for target
DF = dilution factor (if any)

SOILs: concentration (mg/kg) = $\frac{[A_x \times I_s]}{[A_{is} \times RF \times D]} \times DF$

Where:
All variables are equal and
D = (100 - % moisture in sample/100) or 1 for wet weight. (As in the case of drum samples)

The target methods all contain calculations for waters and soils that allow automatic processing and calculations of concentrations to be completed. The user may enter some variables (Dilution Factor) and others are imported from LabNet/LIMS. Sample prep info for VOA's is entered directly into LabNet or via LOTUS spreadsheets into LIMS. The sample volume is considered to be "constant" for calculation purposes, and is always entered as five (5) or twenty-five (25) in the Lotus Spreadsheet. Less sample volume (in the case of waters) and soil weight (in the case of soils) are taken into account in the dilution factor entered by the user. For medium-level soils and waste/drum type samples medium level calculations are needed and actual weights are entered in the spreadsheet.

NOTE: As noted previously, weights <u>are</u> recorded to 0.1 gram. It is SOP to weigh out 5.0 grams (or as appropriate for the dilution), however, to keep data entry and calculations simple. The same holds true for all water volumes.

9.1.2 Accuracy:

$$\%R = \frac{(A_T - A_0)}{A_F} \times 100$$

Where:
A_T = Total amount recovered in fortified sample
A_0 = Amount recovered in unfortified sample
A_F = Amount added to sample

9.1.3 Precision: $\% D = \frac{|B_1 - B_2|}{B_1} \times 100$

$$RPD = \frac{|B_1 - B_2|}{(B_1 + B_2)/2} \times 100$$

Where:
B_1 = %Recovery MS (or LCS)
B_2 = %Recovered MSD (or LCS)

9.1.1.1 Modifications for 8260B quantitation

9.1.1.2 Initial Calibration Criteria

Methods 8000B/8260B require the use of linear or higher order calibration curves for those compounds exceeding 15%.

The following equations apply :

Linear Regression :

$$y=a_0 + (1/a_1)x$$

Quadratic Curve:

$$y = a_o + (a1 * x) + (a2 * x^2)$$

Power Curve :

$$y=e^{a0} * x^{(1/a1)}$$

which is converted to :

$$\ln (y) = (1/a_1) * \ln (x) + a_0$$

$x = Area_{UKN}/Area_{ISTD}$
$y= Amount_{UNK}/Amount_{ISTD}$

Once the $Amount_{UNK}$ is solved, the value is adjusted for total solids, dilution factors etc....to calculate a final concentration.

The quantitation of compounds using either a linear regression, quadratic curve or a power curve as performed automatically by the Target software has been confirmed to be accurate.

Method 8000B/8260B specifies a minimum COD. Method 8260A does not. Any samples analyzed (per client request) as 8260A will not be required to meet this requirement.

The corrective action regarding an initial calibration for method 8260B as it relates to the 0.990 correlation coefficient acceptance criteria is outlined. When a compound has a correlation coefficient less than 0.990, the occurrence is documented by the analyst in the GC/MS VOA CAR/Qualifications Report Logbook. Any corrective action or data qualification is also documented in the CAR/Qualification Logbook. All corrective actions taken may include those listed below.

Samples may be analyzed against an initial calibration that have compounds with a correlation coefficient less than 0.990 and the corrective actions taken may also include some but not all of the following:

- The data for these samples may be reported without qualification if the compounds with a correlation coefficient less than 0.990 are not detected in the sample, therefore no further corrective action is required.
- If a compound is detected in the sample that has a correlation coefficient less than 0.990, the samples may be reanalyzed against an initial calibration with an acceptable correlation coefficient and only the reanalysis will be reported on the sample. If this reanalysis occurs beyond analysis hold times then both analyses on the sample will be reported.
- If a compound is detected in the sample that has a correlation coefficient less than 0.990, the decision to reanalyze or to reported the data without further corrective action is made on a case by case basis with the approval of the Unit Leader, the Section Manager, the Project Manager and the client. The sample results may require qualification for this compound on the report and will be addressed in the case narrative.

9.1.1.3 Continuing Calibration Check

Prior to sample analysis a 10 ppb/ 50 ppb calibration check is completed. All minimum RF's must meet same limits. All CCC's must be less than 20% Drift as calculated below; the analysts may verify %DIFF and only calculate those that are close. (Error may only be made in favor of tighter control).

$$\%Drift = Ci - Cc/Ci \times 100$$

Where:
Ci = standard conc. (10/50)
Cc = measured conc. in cal check

9.1.2 Quantitation of TIC's (Tentatively Identified Compounds)

Quantitation of TIC's is performed by the Target processing software. The formulas above for waters and soils can be used with the following modifications. A_x and A_{is} should be taken from the total ion integration listing accompanying the TIC report produced by the data system. The nearest non-interfered with internal standard should be used. The RF is assumed to be one (1). The concentration is therefore an estimate and is flagged as such with a "J". Any TIC also found in the MB is flagged with a "JB". Any TIC identified with a CAS number is also flagged with an "N", indicating that the ID was based on the mass spectra. The operator should visually confirm that the integration is correct. If not, the peak in question must be manually integrated. The target system automatically calculates the actual concentration of the TIC's, including dilutions and total solids, once that information is retrieved from LabNet / LIMS.

9.2 Operator Data Reduction/Review

The operator does on-screen review of all data and 1) makes judgments concerning the "realness" of those target compounds found and 2) makes judgments concerning the identification of the tentatively identified compounds and 3) modifies the output to produce a data package reflective of those decisions.

9.2.1 Initial Review

The GC/MS VOA area uses two kinds of corrective action documentation. The first consists of CAR Logbooks, that are specific to each instrument. These logbooks contain sections to report out-of-control situations, CA, return-to-control and qualification sections for documenting problems related to general QC : tune, ICAL, CCAL, internal standard areas from CCAL to CCAL, and LCS samples. The second are the Individual CAR's that refer to a single sample # batch. These are used to record events, CA and final actions for surrogates, internal standard areas, carry-over situations, analyses past tune time, MS/MSD data etc...for each sample in the batch. These forms are attached to the COC, along with the samples tracking sheets. Both may be used during initial review of the data. Examples of both can be found in Attachment 3. See Section 8.2 of this SOP for details on CA.

All data is initially reviewed on-screen. The review is both a QC review and a general review as described below.

- The MB contains no interferences or target compounds at the PQL.
- ALL surrogates are in control in the blank. Surrogate limits are listed in Table 1;
- ALL surrogates in samples are in control;
- LCS recoveries meet the limits listed in Table 1; See corrective action section concerning

- compounds and limits for LCS samples. At present, in-house limits have been generated and are in use.
- Internal standard areas and retention times are checked and meet guidelines. Limits are listed in Attachment 2. Additional guidelines can be found in Section 8.2.8.
- The sample does not require any further dilutions or analysis at a more concentrated level. Dilutions are made to keep the target in the upper half of the calibration range. The MS and MSD are never diluted to get spiked or non-spiked compounds within range, as this would reduce the matrix affect assessment.
- Visually confirm complete integration for any large and/or saturated target compounds.
- The sample does not require re-analysis for any other reason (i.e. leak, analysis past tune time, ISTD areas low, etc...).

9.2.2 Identification of Targets

The following guidelines are used in the positive identification of target compounds.

9.2.2.1 "elution of component at the same relative retention time as the standard component."

The elution times should compare within +- 30 s. The standard must be run on the same 12 hour period as the sample. If co-eluting analytes interfere with the comparisons of retention times, other ions characteristic to that compound can be used to confirm relative retention times.

9.2.2.2 "correspondence of the sample component and standard component mass spectrum." Comparisons of sample spectra to standard spectra must be made using standard spectra obtained from the GC/MS system.

All ions present in the standard spectrum at a 10% relative intensity (most abundant ion being 100%) should be present in the sample.

The relative intensities of the above ions should agree within ±20%, between the standard and sample. If an ion is 50% intensity in the standard the corresponding ion must be between 30 and 70% in the sample.
Ions >10% in the sample but not present in the standard should be considered and accounted for. (A user program exists to aid in this).

9.2.2.3 **Operator judgment**. If a compound can not be verified by the above, but in the operators technical judgment the ID is correct, it is reported as such.

9.2.4 Once all positive identification is made, the file is modified to reflect these decisions. At this time TIC's may also be reviewed and named, following the guidelines in

10.2.4. In each case where the file has been edited or manual integrations have taken place the operator must identify, initial and date the changes on the hardcopy. The following guidelines apply :

- Manual integrations should be consistent between all files integrated.
- Manual integrations should not be performed to meet QC criteria.
- Manual integrations are automatically flagged with an "M" on the raw data.
- Excessive manual integrations may reflect an instrumental or methodological problem that should be addressed.

9.2.4.1 Manual integrations are most often performed for the following reasons. If a manual integration is performed for a reason other than listed, the reason will be documented and approved by the section manager.

- Assignment of correct peak that was mis-identified by the system.
- Incomplete auto-integration due to high level of target detected.
- Incomplete auto-integration due to background interference.
- Incorrect auto-integration due to co-elution or near co-elution of compounds.
- Missed peaks.

All integrations are reviewed by the analyst. Spectra and EICP's are printed after any integrations take place (for targets) and are routinely included in the data packages. If EICP's for internals, surrogates, and standards are required to satisfy client deliverable requirements, they can be provided, but will not be routinely added.

Manual integrations may be documented in the narrative if so required, however, references to this SOP will be used for explanations, and any further documentation beyond initials and dates will not be done. All analytes at concentrations less than the Estimated Quantitation Limit are automatically flagged with a J. For waters, "J" values are not reported (nothing below the EQL).

9.2.5 Identification of TIC's

In general, up to as many as 5 non-target compounds are tentatively identified by the data system and operator. Compounds with responses >10% of the nearest ISTD are identified. The data system provides the operator with a SUB ADC C sample spectrum, spectra of the first three matches and a listing of two other possibilities. Molecular formulas, molecular weights and CAS #'s are included. The following guidelines are used:

9.2.5.1 Relative intensities of major ions in the reference spectrum should be present in the sample (ions >10%).

- Relative ions should agree within ±20%;
- Molecular ions in the reference should be in the samples;

- Review the possibility of background and/or co-eluting compounds for those ions present in the sample but not in the standard;
- If ions are present in the sample but not in the standard, review the possibility of the presence of background or co-eluting compounds;
- If ions are present in the standard but not in the sample, review the possibility that the ions were subtracted out because they are also common to the background or co-eluting compounds;
- In the event no valid interpretation can be made, the compound is called "unknown".
- Interpretation can be often narrowed down to a class of compounds, molecular formula or weight.

9.3 Final Review

Once 1) the analysis is determined to be acceptable and 2) the initial review and data reduction has occurred (verifiable on the Tune Form) and 3) the analyst has entered sample prep info into LabNet/LIMS, the following steps occur. The sample prep information, client ID information and some data applicable to fields in the forms is retrieved from LabNet/LIMS. At this point, the analyst then usually prints hard-copies of all the necessary raw data. The analysts review the hard-copies and initial and date them, documenting that review.

All required forms are then generated using the Target software. Most, if not all of these steps, are documented on the tune form. The package is then assembled and ready for the first review.

Upon the first 100% review, the review form is initialed and dated as reviewed. The initial review is normally done by the analyst preparing the data package. The package, with its review sheet, comments and any CAR forms is submitted to the unit leader or section manager for a second review and validation. Once the data passes review in the department, it is submitted to report generation/QA/QC for appropriate follow-up action.

The complete analysis scheme can be summarized below (Section 7.1.1 & 7.1.2) and in Attachment 5. The entire sample tracking system can be summarized in Attachment 5. The Tune Form is used to verify many of these steps of review and data reduction.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

Refer to the SOP entitled "Disposal of Laboratory Waste".

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0

13.0 ATTACHMENTS

Table 1. Estimated Quantitation Limits for Volatile Analytes; Laboratory Statistical Control Limits
Table 2. Characteristic Mass for Purgeable Organics Compounds

Figure 1. Example: Total Ion Chromatogram for 25 mL Purge Water
Figure 2. Example: Total Ion Chromatogram for 5 mL Purge Soil

Attachment 1. Example: Method Listings; Tekmar Conditions; Flow Settings
Attachment 2. Example: Target and Internal Standards; ID Files; ICAL/CCAL; Surrogate Recovery Limits; LCS / MS Recovery Limits; Internal Standard Guidelines
Attachment 3. Example: GC/MS Volatiles/CAR Logbook; Tune Form; Sample Tracking Sheet
Attachment 4. Calibration Evaluation and Acceptance Criteria
Attachment 5. Example: Analysis and Sample Tracking Flowcharts
Attachment 6. Example: Data Review Form

Historical File:

Revision 00: 06/22/92	Revision 04: 07/15/94	Revision 08: 06/13/97
Revision 01: 04/26/93	Revision 05: 11/20/95	Revision 09: 02/11/98
Revision 02: 05/26/93	Revision 06: 04/09/96	Revision 10: 01/29/99
Revision 03: 01/24/94	Revision 07: 04/10/97	Revision 11: 03/08/99
Revision 12: 09/28/00		

Reasons for Change, Revision 12:
- Annual Review.
- Updated LIMS nomenclature to reflect that of LabNet, the new laboratory computer system.

U:\QC\SOP\UMV\8260.DOC

Table 1.

Example: Estimated Quantitation Limits for Volatile Analytes[a]
Laboratory Statistical Control Limits

[a]Estimated Quantitation Limit (EQL) - The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The EQL is generally 5 to 10 times the MDL. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes the EQL analyte concentration is selected for the lowest non-zero standard in the calibration curve. Sample EQLs are highly matrix-dependent. The EQLs listed herein are provided for guidance and may not always be achievable. See the following example information for further guidance on matrix-dependent EQLs.

[b]EQLs listed for soil/sediment are based on wet weight. Normally data is reported on a dry weight basis; therefore, EQLs will be higher, based on the percent dry weight in each sample.

STL Chicago
GC/MS Volatiles Combined MDL/STAT Summary
Method: SW846-8260B

		WATER - 25mL					WATER - 5mL		SOIL - 5030 / 5035					SOIL - 5035(High)	
PARAMETER	CAS #	R.L. ug/L	MDL ug/L	LCL %	UCL %	RPD %	R.L. ug/L	MDL ug/L	R.L. ug/kg	MDL ug/kg	LCL %	UCL %	RPD %	R.L. ug/kg	MDL ug/kg
1,1,1,2-Tetrachloroethane	630-20-6	0.5	0.23	82	123	20	5	0.96	5	0.78	69	119	20	100	25.5
1,1,1-Trichloroethane	71-55-6	0.5	0.29	68	131	21	5	1.2	5	1.4	57	132	20	100	16.5
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.23	72	126	24	5	1.7	5	1.2	63	131	28	100	18.5
1,1,2-Trichloroethane	79-00-5	0.5	0.35	68	136	28	5	1.5	5	0.92	70	136	24	100	31.5
1,1-Dichloroethane	75-34-3	0.5	0.29	58	140	29	5	1.3	5	0.88	63	135	29	100	13.5
1,1-Dichloroethene	75-35-4	0.5	0.34	53	136	28	5	1.7	5	1.4	47	139	34	100	14.0
1,1-Dichloropropene	563-58-6	0.5	0.35	77	136	20	5	1.1	5	1.4	63	141	20	100	18.5
1,2,3-Trichlorobenzene	87-61-6	0.5	0.24	66	133	20	5	4.3	5	3.0	58	129	20	100	49.0
1,2,3-Trichloropropane	96-18-4	0.5	0.31	74	124	20	5	1.2	5	1.6	57	135	20	100	35.0
1,2,4-Trichlorobenzene	120-82-1	0.5	0.24	73	132	20	5	3.3	5	3.1	61	125	20	100	41.5
1,2,4-Trimethylbenzene	95-63-6	0.5	0.37	76	132	20	5	1.1	5	0.97	74	120	20	100	23.0
1,2-Dibromo-3-chloropropane	96-12-8	0.5	0.48	65	126	20	5	1.8	5	2.3	42	140	20	100	22.5
1,2-Dibromoethane	106-93-4	0.5	0.26	71	130	20	5	1.3	5	0.88	66	129	20	100	25.5
1,2-Dichlorobenzene	95-50-1	0.5	0.26	82	123	20	5	1.5	5	1.2	74	120	20	100	17.0
1,2-Dichloroethane	107-06-2	0.5	0.23	70	128	23	5	1.4	5	0.74	52	137	20	100	21.5
1,2-Dichloroethene (total)	540-59-0	0.5	0.63	60	140	20	5	2.4	5	2.0	63	132	20	100	29.0
1,2-Dichloropropane	78-87-5	0.5	0.21	71	128	20	5	1.1	5	0.94	72	129	21	100	17.5
1,3,5-Trichlorobenzene	108-70-3	0.5	0.25	70	130	20	5	2.4	5	2.7	70	130	20	100	29.0
1,3,5-Trimethylbenzene	108-67-8	0.5	0.23	71	132	20	5	1.06	5	0.92	70	117	20	100	19.5
1,3-Dichlorobenzene	541-73-1	0.5	0.26	81	123	20	5	1.5	5	1.4	73	118	20	100	23.0
1,3-Dichloropropane	142-28-9	0.5	0.23	75	124	17	5	1.1	5	0.73	69	128	21	100	23.5
1,4-Dichlorobenzene	106-46-7	0.5	0.23	80	124	20	5	1.6	5	1.5	73	118	20	100	20.5
1-Chlorohexane	544-10-5	0.5	0.34	82	178	20	5	0.90	5	0.86	70	130	20	100	22.5
2,2-Dichloropropane	594-20-7	0.5	0.31	26	169	20	5	4.5	5	3.1	54	132	20	100	11.5
2-Butanone	78-93-3	2.0	1.73	38	132	27	5	1.9	5	5.0	32	155	29	100	51.0
2-Chloro-1,3-Butadiene	126-99-8	0.5	0.48	NA	NA	NA	5	0.29	5	0.82	NA	NA	NA	100	
2-Chloroethylvinylether	110-75-8	2.0	1.36	10	141	20	5	2.26	5	4.0	39	158	20	100	76.0
2-Chlorotoluene	95-49-8	0.5	0.21	73	134	20	5	1.1	5	1.5	70	119	20	100	40.5
2-Hexanone	591-78-6	2.0	0.95	54	124	28	5	1.4	5	4.9	38	154	46	100	52.0
2-Methylnaphthalene	91-57-6														
3-Chloropropene	107-05-1	2.0	0.63	NA	NA	NA	10	1.36	10	1.6	NA	NA	NA	200	17.0
4-Chlorotoluene	106-43-4	0.5	0.21	75	131	20	5	1.2	5	1.0	70	119	20	100	23.0
4-Methyl-2-pentanone	108-10-1	2.0	0.87	53	128	27	5	1.3	5	3.7	44	147	34	100	37.5
Acetone	67-64-1	2.0	1.66	11	155	34	5	4.8	5	4.7	25	188	42	100	29.0
Acetonitrile	75-05-8	40	10.0	NA	NA	NA	40	20.2	40	37.7	NA	NA	NA	800	522
Acrolein	107-02-8	200	67.1	NA	NA	NA	200	74.5	200	148.9	NA	NA	NA	4000	1473
Acrylonitrile	107-13-1	40	6.5	NA	NA	NA	40	16.3	40	35.3	NA	NA	NA	800	307
Benzene	71-43-2	0.5	0.21	71	122	19	5	0.96	5	0.96	69	122	21	100	14.0
bis(chloromethyl)ether	542-88-1	2000		NA	NA	NA					NA	NA	NA		
Bromobenzene	108-86-1	0.5	0.23	83	121	20	5	1.2	5	0.95	71	117	20	100	27.5

STL Chicago
GC/MS Volatiles Combined MDL/STAT Summary
Method: SW846-8260B

		WATER - 25mL					WATER - 5mL		SOIL - 5030 / 5035					SOIL - 5035(High)	
PARAMETER	CAS #	R.L. ug/L	MDL ug/L	LCL %	UCL %	RPD %	R.L. ug/L	MDL ug/L	R.L. ug/kg	MDL ug/kg	LCL %	UCL %	RPD %	R.L. ug/kg	MDL ug/kg
Bromochloromethane	74-97-5	0.5	0.38	46	145	20	5	1.5	5	0.82	56	127	20	100	24.5
Bromodichloromethane	75-27-4	0.5	0.24	76	129	22	5	1.3	5	0.72	66	130	20	100	19.0
Bromoform	75-25-2	0.5	0.25	57	154	20	5	1.1	5	0.80	57	137	25	100	18.0
Bromomethane	74-83-9	0.5	0.39	68	140	20	5	0.86	5	1.2	64	139	18	100	10.5
Carbon Disulfide	75-15-0	2.0	0.49	24	137	37	5	1.6	5	1.0	17	167	45	100	20.5
Carbon Tetrachloride	56-23-5	0.5	0.31	69	133	15	5	0.89	5	0.81	48	133	19	100	16.5
Chlorobenzene	108-90-7	0.5	0.23	83	123	16	5	1.0	5	0.76	75	121	21	100	22.0
Chloroethane	75-00-3	0.5	0.33	58	141	21	5	1.3	5	2.5	60	136	17	100	20.0
Chloroform	67-66-3	0.5	0.29	71	132	27	5	1.6	5	0.78	69	129	18	100	18.0
Chloromethane	74-87-3	0.5	0.44	39	136	18	5	2.7	5	1.8	44	132	18	100	23.5
cis-1,2-Dichloroethene	156-59-2	0.5	0.33	67	129	24	5	1.3	5	0.96	69	127	20	100	17.0
cis-1,3-Dichloropropene	10061-01-5	0.5	0.26	69	122	21	5	1.2	5	0.86	63	122	20	100	22.5
Crotononitrile	4786-20-3	40	7.0	NA	NA	NA	40	15.4	40	38.1	NA	NA	NA	800	273
Dibromochloromethane	124-48-1	0.5	0.24	75	131	19	5	1.1	5	0.52	59	132	25	100	19.0
Dibromomethane	74-95-3	0.5	0.23	72	127	20	5	1.3	5	0.74	64	128	20	100	22.5
Dichlorodifluoromethane	75-71-8	0.5	0.43	18	138	20	5	1.2	5	1.4	15	128	20	100	12.0
Ethyl acetate	141-78-6	5.0	3.1	NA	NA	NA	50	10.2	50	9.2	NA	NA	NA	1000	108
Ethyl ether	60-29-7	0.5	0.28	48	137	20	5	0.38	5	0.79	70	130	20	100	19.0
Ethylbenzene	100-41-4	0.5	0.22	78	123	17	5	0.93	5	1.2	71	123	21	100	22.5
Ethylmethacrylate	97-63-2	2.0	0.77	NA	NA	NA	10	0.99	10	1.5	NA	NA	NA	200	24.0
Heptane	142-82-5	0.5	0.48	13	142	20	5	0.59	5	1.3	30	152	20	100	38.0
Hexachlorobutadiene	87-68-3	0.5	0.35	62	140	20	5	3.5	5	2.6	52	130	20	100	38.5
Hexane	110-54-3	0.5	0.42	10	133	20	5	0.66	5	1.3	25	169	20	100	27.5
Iodomethane	74-88-4	2.0	1.1	70	130	20	10	1.09	10	1.4	70	130	20	200	25.5
Isobutanol	78-83-1	100	44.6	NA	NA	NA	400	122	400	135.6	NA	NA	NA	8000	3741
Isopropyl ether	108-20-3	0.5	0.18	NA	NA	NA	5	0.32	5	0.69	NA	NA	NA	100	9.5
Isopropylbenzene	98-82-8	0.5	0.23	70	135	20	5	0.87	5	0.88	68	119	20	100	20.0
Methacrylonitrile	126-98-7	2.0	0.81	NA	NA	NA	10	1.8	10	2.4	NA	NA	NA	200	40.5
Methylene Chloride	75-09-2	0.5	0.32	59	130	28	5	1.4	5	1.1	62	131	22	100	20.0
Methylmethacrylate	80-62-6	2.0	1.2	NA	NA	NA	10	1.5	10	1.5	NA	NA	NA	200	19.0
Methyl-tert-butyl ether	1634-04-4	0.5	0.32	70	130	20	5	2.0	5	1.1	70	130	20	100	30.5
Naphthalene	91-20-3	0.5	1.1	58	134	20	5	3.6	5	2.9	52	136	20	100	38.0
n-Butylbenzene	104-51-8	0.5	0.24	70	142	20	5	1.5	5	1.7	67	126	20	100	18.5
n-Propylbenzene	103-65-1	0.5	0.23	70	141	20	5	0.96	5	1.4	69	123	20	100	27.5
o-Xylene	95-47-6	0.5	0.22	83	125	20	5	0.98	5	0.88	71	123	20	100	23.5
p,m-Xylene	000-00-0	0.5	0.46	82	127	20	5	1.8	5	1.7	70	124	20	200	50.0
Pentachloroethane	76-01-7	2.0	0.56	NA	NA	NA	10	1.06	10	2.4	NA	NA	NA	200	83.0
p-Isopropyltoluene	99-87-6	0.5	0.24	68	137	20	5	1.0	5	1.3	70	120	20	100	23.5
Propionitrile	107-12-0	40	6.9	NA	NA	NA	40	14.5	40	32.1	NA	NA	NA	800	360
sec-Butylbenzene	135-98-8	0.5	0.26	70	142	20	5	0.96	5	1.0	72	124	20	100	20.5
Styrene	100-42-5	0.5	0.23	82	123	19	5	1.1	5	1.0	74	127	20	100	28.5

STL Chicago
GC/MS Volatiles Combined MDL/STAT Summary
Method: SW846-8260B

		WATER - 25mL					WATER - 5mL		SOIL - 5030 / 5035					SOIL - 5035(High)	
PARAMETER	CAS #	R.L. ug/L	MDL ug/L	LCL %	UCL %	RPD %	R.L. ug/L	MDL ug/L	R.L. ug/kg	MDL ug/kg	LCL %	UCL %	RPD %	R.L. ug/kg	MDL ug/kg
tert-Butylbenzene	98-06-6	0.5	0.32	72	137	20	5	0.98	5	1.0	70	121	20	100	13.5
Tetrachloroethene	127-18-4	0.5	0.28	74	132	21	5	2.59	5	3.6	69	122	22	100	23.0
Tetrahydrofuran	109-99-9	5.0	3.7	75	184	20	5	1.8	5	4.8	34	188	20	100	43.0
Toluene	108-88-3	0.5	0.22	77	122	21	5	1.1	5	0.88	70	124	20	100	18.0
trans-1,2-Dichloroethene	156-60-5	0.5	0.31	60	140	20	5	1.1	5	1.1	63	132	20	100	13.5
trans-1,3-Dichloropropene	10061-02-6	0.5	0.25	69	132	26	5	1.4	5	0.90	67	128	21	100	19.5
trans-1,4-Dichoro-2-butene	110-57-6	2.0	0.77	NA	NA	NA	10	1.07	10	2.7	NA	NA	NA	200	30.5
Trichloroethene	79-01-6	0.5	0.26	78	126	20	5	1.6	5	0.93	69	123	20	100	21.5
Trichlorofluoromethane	75-69-4	0.5	0.44	46	162	20	5	3.2	5	1.5	52	129	20	100	19.5
Trichlorotrifluoroethane	76-13-1	0.5	0.39	NA	NA	NA	5	1.0	5	1.1	NA	NA	NA	100	15.0
Vinyl acetate	108-05-4	2.0	0.83	32	168	20	5	1.4	5	1.9	23	243	50	100	32.0
Vinyl chloride	75-01-4	0.5	0.31	51	138	19	5	1.2	5	1.3	54	134	17	100	18.0
Xylene (total)	1330-20-7	0.5	0.46	82	130	20	5	1.8	5	1.7	73	126	21	100	50.0
Surrogates:															
1,2-Dichloroethane-d4				66	132						43	139			
4-Bromofluorobenzene				79	122						57	124			
Toluene-d8				78	128						70	128			
Dibromofluoromethane				66	132						64	132			

Table 2

Characteristic Mass (m/z) for Purgeable Organic Compounds

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion
Benzene	78	---
Bromobenzene	156	77,158
Bromochloromethane	128	49,130
Bromodichloromethane	83	85,127
Bromoform	173	175,254
Bromomethane	94	96
n-Butylbenzene	91	92,134
sec-Butylbenzene	105	134
tert-Butylbenzene	119	91,134
Carbon tetrachloride	117	119
Chlorobenzene	112	77,114
Chloroethane	64	66
Chloroform	83	85
Chloromethane	50	52
2-Chlorotoluene	91	126
4-Chlorotoluene	91	126
1,2-Dibromo-3-chloropropane	75	155,157
Dibromochloromethane	129	127
1,2-Dibromoethane	107	109,188
Dibromomethane	93	95,174
1,2-Dichlorobenzene	146	111,148
1,3-Dichlorobenzene	146	111,148
1,4-Dichlorobenzene	146	111,148
Dichlorodifluoromethane	85	87
1,1-Dichloroethane	63	65,83
1,2-Dichloroethane	62	98
1,1-Dichloroethene	96	61,63
cis-1,2-Dichloroethene	96	61,98
trans-1,2-Dichloroethene	96	61,98
1,2-Dichloropropane	63	112
1,3-Dichloropropane	76	78
2,2-Dichloropropane	77	97
1,1-Dichloropropene	75	110,77
Ethylbenzene	91	106
Hexachlorobutadiene	225	223,227
Isopropylbenzene	105	120
p-Isopropylbenzene	119	134, 91
Methylene chloride	84	---
Naphthalene	128	86, 49
n-Propylbenzene	91	---
Styrene	104	120
1,1,1,2-Tetrachloroethane	131	78
1,1,2,2-Tetrachloroethane	83	133, 119
Tetrachloroethene	166	131, 85

Table 2
(continued)
Characteristic Mass (m/z) for Purgeable Organic Compounds

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion
Toluene	92	168, 129
1,2,3-Trichlorobenzene	180	91
1,2,4-Trichlorobenzene	180	182, 145
1,1,1-Trichloroethane	97	182, 145
1,1,2-Trichloroethane	83	99, 61
Trichloroethene	95	97, 85
Trichlorofluoromethane	101	130, 132
1,2,3-Trichloropropane	75	77
1,2,4-Trimethylbenzene	105	120
1,3,5-Trimethylbenzene	105	120
Vinyl chloride	62	64
o-Xylene	106	91
m-Xylene	106	91
p-Xylene	106	91
cis-1,3-Dichloropropene	75	77
trans-1,3-Dichloropropene	75	77
Internal Std./Surrogates		
4-Bromofluorobenzene (S)	95	174, 176
1,4-Dichlorobenzene-d_4 (IS)	152	150
Pentafluorobenzene (IS)	168	
Chlorobenzene-d_5 (IS)	117	
1,4-Difluorobenzene (IS)	114	
1,2-Dichloroethane-d_4 (S)	65	
Toluene-d_8 (S)	98	
Dibromofluoromethane (S)	113	

*NOTE: The primary and secondary ions listed here are taken directly from SW-846 Method 8260. The laboratory uses secondary ions in the cases of Ethylbenzene, Toluene, 1,1,2-Trichloroethane, Trichloroethene, 1,2,3-Trichloropropane and Xylenes due to interferences and/or to maintain consistency between methods.

Figure 1.

Example: Total Ion Chromatogram for 25 mL Purge Water

Data File: /var/chem/gcl6.i/jun0100.b/oa601.d

Date : 01-JUN-2000 08:20

Client ID: VSTD010

Instrument: gcl6.i

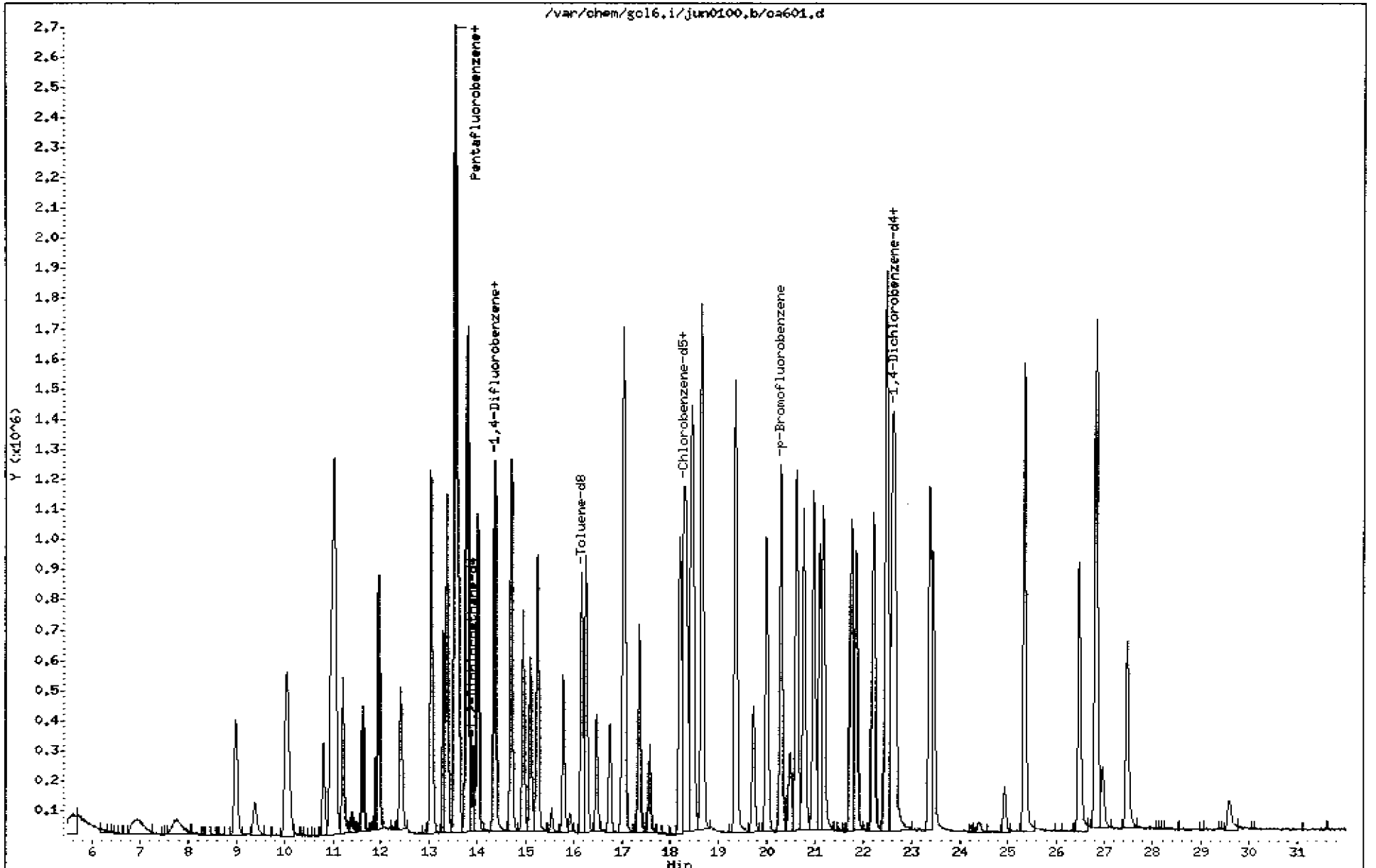
Sample Info: VSTD010 NA601

Purge Volume: 25.0

Operator: KEV

Column phase: Cap

Column diameter: 0.53



VOLATILE REPORT SW846 METHOD 8260B WATERS

Data file : /var/chem/gcl6.i/jun0100.b/oa601.d
Lab Smp Id: VSTD010 Client Smp ID: VSTD010
Inj Date : 01-JUN-2000 08:20
Operator : KEV Inst ID: gcl6.i
Smp Info : VSTD010 NA601
Misc Info : GCL#6,1,25MLOFW+5ULIS,SS
Comment : HP 5972/ 5890 GC TEKMAR 3000/2016
Method : /var/chem/gcl6.i/jun0100.b/25ml6w.m
Meth Date : 17-Jun-2000 18:41 kozubald Quant Type: ISTD
Cal Date : 19-MAY-2000 23:03 Cal File: oo519.d
Als bottle: 2 Continuing Calibration Sample
Dil Factor: 1.00000
Integrator: HP RTE Compound Sublist: ICAL1.sub
Target Version: 3.50
Processing Host: manatee

Concentration Formula: Amt * DF * Uf * 1/Vo * CpndVariable

Name	Value	Description
DF	1.00000	Dilution Factor
Uf	25.00000	ng unit correction factor
Vo	25.00000	Sample Volume purged (mL)
Cpnd Variable		Local Compound Variable

Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RFSPONSF	AMOUNTS CAL-AMT (ug/L)	ON-COL (ug/L)
1 Dichlorodifluoromethane	85	5.626	5.626	(0.416)	1254679	10.0000	7.855(M)
2 Chloromethane	50	6.956	6.956	(0.514)	550332	10.0000	9.222(M)
3 Vinyl chloride	62	7.764	7.764	(0.573)	517969	10.0000	9.005(M)
5 Bromomethane	94	8.980	8.980	(0.663)	617363	10.0000	9.465
6 Chloroethane	64	9.379	9.379	(0.693)	243996	10.0000	10.431
7 Trichlorofluoromethane	101	10.031	10.031	(0.741)	1198473	10.0000	9.910
11 1,1-Dichloroethene	96	10.943	10.943	(0.808)	379987	10.0000	8.980
18 Methylene chloride	84	11.621	11.621	(0.858)	261585	10.0000	8.056
21 trans-1,2-Dichloroethene	96	11.951	11.951	(0.883)	322734	10.0000	8.194
24 1,1-Dichloroethane	63	12.411	12.411	(0.917)	703371	10.0000	9.040
30 2,2-Dichloropropane	77	13.045	13.045	(0.963)	561476	10.0000	9.433
29 cis-1,2-Dichloroethene	96	13.045	13.045	(0.963)	373146	10.0000	11.957
33 Bromochloromethane	128	13.297	13.297	(0.982)	231953	10.0000	11.537
36 Chloroform	83	13.376	13.376	(0.988)	1063059	10.0000	9.722
39 1,1,1-Trichloroethane	97	13.601	13.601	(1.004)	992630	10.0000	8.627(M)

Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RESPONSE	AMOUNTS CAL-AMT (ug/L)	AMOUNTS ON-COL (ug/L)
* 37 Pentafluorobenzene	168	13.541	13.541	(1.000)	1551167	10.0000	
40 1,1-Dichloropropene	75	13.767	13.767	(1.017)	693229	10.0000	9.843
41 Carbon tetrachloride	117	13.801	13.801	(0.961)	1122933	10.0000	10.691
$ 43 1,2-Dichloroethane-d4	65	13.906	13.906	(0.968)	347775	10.0000	8.474
45 Benzene	78	14.001	14.001	(0.975)	1058955	10.0000	10.538
44 1,2-Dichloroethane	62	13.992	13.992	(0.974)	382381	10.0000	8.678
* 49 1,4-Difluorobenzene	114	14.366	14.366	(1.000)	1303075	10.0000	
51 Trichloroethene	130	14.705	14.705	(1.024)	654065	10.0000	11.039
52 1,2-Dichloropropane	63	14.948	14.948	(1.040)	452617	10.0000	10.657
54 Dibromomethane	93	15.096	15.096	(1.051)	382087	10.0000	11.401
55 Bromodichloromethane	83	15.252	15.252	(1.062)	1021162	10.0000	10.593
57 cis-1,3-Dichloropropene	75	15.782	15.782	(1.099)	507822	10.0000	9.451
$ 59 Toluene-d8	98	16.164	16.164	(1.125)	971773	10.0000	8.205
60 Toluene	92	16.260	16.260	(1.132)	695377	10.0000	8.971
62 trans-1,3-Dichloropropene	75	16.468	16.468	(1.146)	371899	10.0000	8.702
64 1,1,2-Trichloroethane	97	16.746	16.746	(1.237)	206076	10.0000	8.196
67 Tetrachloroethene	166	17.050	17.050	(0.933)	953484	10.0000	11.583
65 1,3-Dichloropropane	76	16.998	16.998	(0.930)	346737	10.0000	9.732
68 Dibromochloromethane	129	17.354	17.354	(0.949)	695416	10.0000	12.335
69 1,2-Dibromoethane	107	17.572	17.572	(1.223)	397478	10.0000	11.248
* 71 Chlorobenzene-d5	117	18.284	18.284	(1.000)	965862	10.0000	
72 Chlorobenzene	112	18.336	18.336	(1.003)	848194	10.0000	10.116
73 1,1,1,2-Tetrachloroethane	131	18.432	18.432	(1.008)	588489	10.0000	10.955
74 Ethylbenzene	106	18.466	18.466	(1.010)	375303	10.0000	9.597
75 p,m-Xylene	91	18.649	18.649	(1.020)	2241736	20.0000	18.508
77 o-Xylene	91	19.344	19.344	(1.058)	1116262	10.0000	9.322
78 Styrene	104	19.361	19.361	(1.059)	681089	10.0000	9.178
79 Bromoform	173	19.717	19.717	(1.078)	449810	10.0000	13.044
80 Isopropylbenzene	105	19.995	19.995	(0.885)	1504461	10.0000	8.973
$ 82 p-Bromofluorobenzene	95	20.291	20.291	(1.110)	926691	10.0000	10.844
85 Bromobenzene	156	20.612	20.612	(0.912)	606074	10.0000	10.832
83 1,1,2,2-Tetrachloroethane	83	20.464	20.464	(0.906)	341206	10.0000	11.489
84 1,2,3-Trichloropropane	110	20.586	20.586	(0.911)	63110	10.0000	9.441
87 n-Propylbenzene	91	20.768	20.768	(0.919)	2086630	10.0000	9.716
88 2-Chlorotoluene	91	20.968	20.968	(0.928)	1490911	10.0000	10.419
89 1,3,5-Trimethylbenzene	105	21.090	21.090	(0.933)	1161487	10.0000	9.046
90 4-Chlorotoluene	91	21.168	21.168	(0.937)	1534387	10.0000	10.621
91 tert-Butylbenzene	119	21.759	21.759	(0.963)	1312673	10.0000	9.316
92 1,2,4-Trimethylbenzene	105	21.854	21.854	(0.967)	1172902	10.0000	9.191
94 sec-Butylbenzene	105	22.211	22.211	(0.983)	1869297	10.0000	9.372
95 1,3-Dichlorobenzene	146	22.463	22.463	(0.994)	1019366	10.0000	10.436
96 p-Isopropyltoluene	119	22.497	22.497	(0.996)	1457857	10.0000	9.142
98 1,4-Dichlorobenzene	146	22.645	22.645	(1.002)	973900	10.0000	9.723
100 1,2-Dichlorobenzene	146	23.436	23.436	(1.037)	784228	10.0000	10.228
99 n-Butylbenzene	91	23.366	23.366	(1.034)	1676028	10.0000	9.514
102 1,2-Dibromo-3-Chloropropane	75	24.938	24.938	(1.104)	79323	10.0000	11.354
104 1,2,4-Trichlorobenzene	180	26.485	26.485	(1.172)	642331	10.0000	10.159

	Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RESPONSE	AMOUNTS CAL-AMT (ug/l)	AMOUNTS ON-COL (ug/l)
	105 Hexachlorobutadiene	225	26.832	26.832	(1.188)	962990	10.0000	13.076
	106 Naphthalene	128	26.971	26.971	(1.194)	350573	10.0000	9.174
	107 1,2,3-Trichlorobenzene	180	27.475	27.475	(1.216)	478289	10.0000	10.050
	13 Acetone	43	11.039	11.039	(0.815)	50137	10.0000	9.559
	14 Carbon Disulfide	76	11.195	11.195	(0.827)	1367982	10.0000	11.479
	25 Vinyl Acetate	43	12.455	12.455	(0.920)	317985	10.0000	7.576
	28 2-Butanone	43	13.037	13.037	(0.963)	38970	10.0000	11.253
	56 2-Chloroethylvinylether	63	15.539	15.539	(1.082)	63689	10.0000	10.274
	58 4-Methyl-2-pentanone	43	15.921	15.921	(1.108)	108858	10.0000	8.934
	66 2-Hexanone	43	17.033	17.033	(0.932)	63171	10.0000	9.224
	16 Acetonitrile	41	11.395	11.395	(0.842)	96860	160.000	151.41
	20 Acrylonitrile	53	11.890	11.890	(0.878)	267045	160.000	137.83
	31 Propionitrile	54	13.080	13.080	(0.910)	118472	160.000	235.50
	47 Crotononitrile	67	14.331	14.331	(0.998)	123484	160.000	167.99
M	46 1,2-Dichloroethene (total)	96				695880	20.0000	19.715
M	101 Xylene (total)	91				3357998	10.0000	28.044
	22 Methyl-tert-Butyl Ether	73	11.968	11.968	(0.884)	213599	10.0000	6.150
	10 Acrolein	56	10.795	10.795	(0.797)	462653	800.000	597.74
	35 Tetrahydrofuran	42	13.376	13.376	(0.988)	227358	100.000	103.42
	70 1-Chlorohexane	91	18.197	18.197	(1.344)	611347	10.0000	8.188
	103 1,3,5-Trichlorobenzene	180	25.347	25.347	(1.122)	1037669	10.0000	10.496
	12 Trichlorotrifluoroethane	101	11.021	11.021	(0.814)	1199625	10.0000	10.253
$	38 Dibromofluoromethane	113	13.541	13.541	(1.000)	1066061	10.0000	11.028
^	97 1,4-Dichlorobenzene-d4	152	22.593	22.593	(1.000)	721821	10.0000	
	108 2-Methylnaphthalene	142	29.595	29.595	(1.310)	161932	10.0000	7.585

QC Flag Legend

M - Compound response manually integrated.

CONTINUING CALIBRATION COMPOUNDS

Instrument ID: gcl7.i Injection Date: 30-MAY-2000 08:28
Lab File ID: ra530.d Init. Cal. Date(s): 01-MAY-2000 29-MAY-2000
Analysis Type: WATER Init. Cal. Times: 15:04 22:30
Lab Sample ID: VSTD050 Quant Type: ISTD
Method: /var/chem/gcl7.i/may3000.b/5ml7w.m

	COMPOUND	RRF / AMOUNT	RF50	CCAL RRF50	MIN RRF	%D / %DRIFT	MAX %D / %DRIFT	CURVE TYPE	
	1 Dichlorodifluoromethane	0.67795	0.66109	0.66109	0.010	-2.48703	100	Averaged	
	2 Chloromethane	0.81647	0.85510	0.85510	0.100	4.73189	100	Averaged	
	3 Vinyl chloride	0.73759	0.75267	0.75267	0.010	2.04453	20.00000	Averaged	
	5 Bromomethane	0.16475	0.16850	0.16850	0.010	2.27568	100	Averaged	
	6 Chloroethane	0.10558	0.10858	0.10858	0.010	2.83964	100	Averaged	
	7 Trichlorofluoromethane	39.61589	50.00000	0.23467	0.010	-20.76822	0.000e+00	Power	<-
	10 1,1-Dichloroethene	0.39804	0.39147	0.39147	0.010	-1.65000	20.00000	Averaged	
	17 Methylene chloride	0.49564	0.52221	0.52221	0.010	5.36247	100	Averaged	
	18 trans-1,2-Dichloroethene	0.53493	0.52896	0.52896	0.010	-1.11668	100	Averaged	
	22 1,1-Dichloroethane	0.92220	0.89753	0.89753	0.100	-2.67541	100	Averaged	
	26 2,2-Dichloropropane	0.65573	0.66346	0.66346	0.010	1.17838	100	Averaged	
	27 cis-1,2-Dichloroethene	0.56830	0.56061	0.56061	0.010	-1.35262	100	Averaged	
	32 Bromochloromethane	0.28472	0.27745	0.27745	0.010	-2.55385	100	Averaged	
	35 Chloroform	0.85183	0.83238	0.83238	0.010	-2.28333	20.00000	Averaged	
	36 1,1,1-Trichloroethane	0.69032	0.69015	0.69015	0.010	-0.02508	100	Averaged	
	40 1,1-Dichloropropene	0.59290	0.57951	0.57951	0.010	-2.25792	100	Averaged	
	39 Carbon tetrachloride	0.37234	0.36584	0.36584	0.010	-1.74589	100	Averaged	
$	41 1,2 Dichloroethane-d4	0.25515	0.27034	0.27034	0.010	5.95327	100	Averaged	
	43 Benzene	1.26595	1.25422	1.25422	0.010	-0.92657	100	Averaged	
	44 1,2-Dichloroethane	0.39300	0.37560	0.37560	0.010	-4.42874	100	Averaged	
	49 Trichloroethene	0.36826	0.36250	0.36250	0.010	-1.56614	100	Averaged	
	50 1,2-Dichloropropane	0.36740	0.35364	0.35364	0.010	-3.74644	20.00000	Averaged	
	51 Dibromomethane	0.22611	0.21988	0.21988	0.010	-2.75457	100	Averaged	
	53 Bromodichloromethane	0.40036	0.40595	0.40595	0.010	1.39750	100	Averaged	
	57 cis-1,3-Dichloropropene	0.48506	0.49097	0.49097	0.010	1.21916	100	Averaged	
$	59 Toluene-d8	0.90973	1.00175	1.00175	0.010	10.11542	100	Averaged	
	60 Toluene	0.82612	0.83834	0.83834	0.010	1.47955	20.00000	Averaged	
	61 trans-1,3-Dichloropropene	0.43849	0.46367	0.46367	0.010	5.74248	100	Averaged	
	63 1,1,2-Trichloroethane	0.41493	0.43589	0.43589	0.010	5.04910	100	Averaged	
	64 Tetrachloroethene	0.45776	0.42616	0.42616	0.010	-6.90389	100	Averaged	
	65 1,3-Dichloropropane	0.55866	0.54016	0.54016	0.010	-3.31206	100	Averaged	
	67 Dibromochloromethane	0.35164	0.35401	0.35401	0.010	0.67594	100	Averaged	
	68 1,2-Dibromoethane	0.32199	0.33521	0.33521	0.010	4.10581	100	Averaged	
	71 Chlorobenzene	1.04791	1.04627	1.04627	0.300	-0.15728	100	Averaged	
	72 1,1,1,2-Tetrachloroethane	0.34529	0.34491	0.34491	0.010	-0.10878	100	Averaged	
	73 Ethylbenzene	0.52659	0.52224	0.52224	0.010	-0.82636	20.00000	Averaged	

Tekmar Conditions

Trap Temp. Prior to Purge	< 30°
Desorb Preheat	100°
Desorb	180°
Bake	225°
Purge Time	10 - 11 min
Desorb	4 min
Bake Time	10 - 11 min

The bake time on instrument #6 is slightly longer

Flow Conditions

Purge Pressure	20 psi
Purge Flow Rate	40 mLs/min

Flow Adjustment

Capillary Column: 5970/5971/MSD's; 5995 Benchtop

- Make-up gas off/separator pump on: flow through separator is 5-10 mLs/minutes.
- Open make-up gas: adjust until ~30 mLs/minute through the separator is achieved (or adjust to 0.5 torr on gauge).

(Flow into the Mass Spec is ≤ 1 mL/minute)

Approximate Vacuums (at ambient temperature)

5971	~5 x 10^{-6} torr
5970	~2-3 x 10^{-5} torr
5995	~1-2 x 10^{-5} torr

Attachment 2.

Example: Target and Internal Standards; ID File Listings;
Initial Calibration/Continuing Calibration
Surrogate Recovery Limits; LCS / MS Recovery Limits
Internal Standard Guidelines

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Calibration File Names:
Level 1: /var/chem/gc16.i/may190025ml6w.b/og519.d
Level 2: /var/chem/gc16.i/may190025ml6w.b/oh519.d
Level 3: /var/chem/gc16.i/may190025ml6w.b/oi519.d
Level 4: /var/chem/gc16.i/may190025ml6w.b/oj519.d
Level 5: /var/chem/gc16.i/may190025ml6w.b/ok519.d
Level 6: /var/chem/gc16.i/may190025ml6w.b/ol519.d
Level 7: /var/chem/gc16.i/may190025ml6w.b/om519.d
Level 8: /var/chem/gc16.i/may190025ml6w.b/on519.d
Level 9: /var/chem/gc16.i/may190025ml6w.b/oo519.d

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
1 Dichlorodifluoromethane	1.10908	1.02774	0.93379	1.03650	1.00051	1.06158					
	1.08454	0.85990	1.15420				AVRG		1.02976		8.73717
2 Chloromethane	0.33288	0.33899	0.34249	0.37247	0.38408	0.42315					
	0.43450	0.39982	0.43415				AVRG		0.38472		10.61339
3 Vinyl chloride	0.32254	0.32822	0.35455	0.37025	0.36477	0.39625					
	0.41416	0.36091	0.42565				AVRG		0.37081		9.57124
4 1,3-Butadiene	0.12442	0.12167	0.12250	0.11810	0.14253	0.13100					
	0.13775	0.12272	0.13089				AVRG		0.12795		6.37777
5 Bromomethane	0.40806	0.35190	0.37732	0.42182	0.40464	0.44692					
	0.45503	0.43909	0.47977				AVRG		0.42050		9.48499

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Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2	
6 Chloroethane	0.13843	0.13712	0.14165	0.15589	0.14603	0.15845						
	0.16268	0.15541	0.16152				AVRG		0.15080		6.66576	
7 Trichlorofluoromethane	0.57822	0.68669	0.74978	0.82427	0.82230	0.83189						
	0.87745	0.71555	0.93080				AVRG		0.77966		13.84127	
8 2-Propanol	+++++	+++++	+++++	+++++	+++++	+++++						
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00	<-
9 Ethyl ether	0.06233	0.06417	0.05752	0.05130	0.06257	0.06120						
	0.05987	0.05701	0.06304				AVRG		0.05878		7.53218	
10 Acrolein	+++++	0.00546	0.00490	0.00513	0.00405	0.00429						
	0.00520	0.00589	0.00499				AVRG		0.00499		11.89646	
11 1,1-Dichloroethene	0.26168	0.25009	0.26289	0.29514	0.24389	0.26021						
	0.31195	0.25977	0.30963				AVRG		0.27281		9.42650	
12 Trichlorotrifluoroethane	0.79425	0.72925	0.73226	0.83603	0.62582	0.67254						
	0.82875	0.71842	0.85031				AVRG		0.75429		10.30873	
13 Acetone	+++++	9471	17842	30088	49953	61857						
	90496	73102	272519				LINR	0.00930	0.03414		0.99563	
14 Carbon Disulfide	+++++	0.76626	0.76601	0.75184	0.63930	0.78092						
	0.83436	0.73152	0.67420				AVRG		0.75833		9.07205	

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Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients c	m1	m2	%RSD or R^2
15 Iodomethane	+++++	1.39622	1.36021	1.46187	1.53324	1.49366					
	1.42951	1.41731	1.39514				AVRG		1.43590		3.97795
16 Acetonitrile	+++++	22444	28973	47984	59657	116961					
	146453	123446	272291				LINR	1.52815	0.00459		0.96978 <-
17 3-Chloropropene	+++++	0.09464	0.08797	0.09227	0.08490	0.09232					
	0.08699	0.08474	0.07677				AVRG		0.08863		6.87332
18 Methylene chloride	0.21705	0.20339	0.21040	0.21519	0.19700	0.20293					
	0.22514	0.22474	0.22814				AVRG		0.20933		10.34417
19 tert-Butyl alcohol	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
20 Acrylonitrile	+++++	70143	93651	139265	177103	362032					
	461400	372608	835609				LINR	1.51453	0.01403		0.97199 <-
21 trans-1,2-Dichloroethene	0.25323	0.22834	0.25572	0.26257	0.20084	0.25046					
	0.28236	0.26055	0.26976				AVRG		0.25391		10.50811
22 Methyl-tert-Butyl Ether	0.23777	0.23106	0.23060	0.21883	0.17244	0.20711					
	0.22457	0.26272	0.23006				AVRG		0.22391		10.92733
23 Hexane	0.20057	0.18758	0.17997	0.16180	0.18875	0.16947					
	0.17745	0.15040	0.16068				AVRG		0.17518		9.13009

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
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Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
24 1,1-Dichloroethane	0.47425	0.48959	0.50347	0.53442	0.43585	0.48664					
	0.54178	0.50227	0.54591				AVRG		0.50158		7.08339
25 Vinyl Acetate	+++++	0.30919	0.29695	0.26596	0.22817	0.23643					
	0.26445	0.29346	0.27018				AVRG		0.27060		10.57615
26 Isopropyl ether	0.52424	0.49502	0.44941	0.44076	0.48069	0.47993					
	0.46888	0.45990	0.47567				AVRG		0.47494		5.25085
27 2-Chloro-1,3-butadiene	0.73876	0.69139	0.64481	0.64932	0.71261	0.70875					
	0.69376	0.66714	0.67038				AVRG		0.68633		4.53170
28 2-Butanone	+++++	0.02067	0.02439	0.02467	0.02444	0.02000					
	0.02086	0.02436	0.01921				AVRG		0.02233		10.48234
29 cis-1,2-Dichloroethene	0.21445	0.17873	0.18826	0.20064	0.22434	0.20593					
	0.19627	0.20078	0.20129				AVRG		0.20119		6.64668
30 2,2-Dichloropropane	0.44518	0.37082	0.36681	0.40960	0.38454	0.33488					
	0.35045	0.43134	0.35984				AVRG		0.38372		9.76395
31 Propionitrile	+++++	0.00391	0.00373	0.00404	0.00399	0.00379					
	0.00355	0.00421	0.00366				AVRG		0.00386		5.60841 <-
32 Ethyl Acetate	0.03395	0.03500	0.03233	0.03319	0.03719	0.03612					
	0.03506	0.03724	0.04047				AVRG		0.03562		6.95662

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
33 Bromochloromethane	0.12724	0.12563	0.13379	0.13570	0.12481	0.12208					
	0.12963	0.13336	0.13429				AVRG		0.12961		3.77809
34 Methacrylonitrile	+++++	0.01723	0.01558	0.01787	0.01971	0.01874					
	0.01837	0.01963	0.02144				AVRG		0.01870		8.29939
35 Tetrahydrofuran	0.01405	0.01269	0.01487	0.01451	0.01274	0.01374					
	0.01432	0.01651	0.01410				AVRG		0.01417		8.10408
36 Chloroform	0.71369	0.67371	0.71024	0.75628	0.65964	0.68497					
	0.72695	0.69333	0.72567				AVRG		0.70494		4.26019
39 1,1,1-Trichloroethane	0.80909	0.72447	0.73284	0.80585	0.69704	0.68467					
	0.75019	0.71996	0.77158				AVRG		0.74174		6.66719
40 1,1-Dichloropropene	0.45937	0.43794	0.45781	0.48804	0.41617	0.43271					
	0.48108	0.42953	0.48379				AVRG		0.45405		5.80827
41 Carbon tetrachloride	0.85949	0.76753	0.81201	0.85735	0.74385	0.74409					
	0.85182	0.73493	0.87334				AVRG		0.80605		7.28224
42 Isobutanol	---++	0.00072	0.00067	0.00083	0.00094	0.00083					
	0.00084	0.00083	0.00097				AVRG		0.00083		11.99833 <-
44 1,2-Dichloroethane	0.35279	0.34857	0.35514	0.34937	0.31153	0.31590					
	0.33816	0.33949	0.33240				AVRG		0.33815		4.64773

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
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Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2	
45 Benzene	0.81918	0.76868	0.76832	0.78154	0.71768	0.74766						
	0.80766	0.74307	0.78579				AVRG		0.77118		4.15289	
M 46 1,2-Dichloroethene (total)	0.23384	0.20384	0.22199	0.23160	0.21264	0.22820						
	0.23961	0.23067	0.24554				AVRG		0.22755		5.71047	
47 Crotononitrile	+++++	0.00668	0.00588	0.00510	0.00457	0.00511						
	0.00532	0.00577	0.00568				AVRG		0.00564		11.40358	<-
48 Heptane	0.41248	0.37916	0.37721	0.35008	0.41350	0.37682						
	0.38693	0.34154	0.36391				AVRG		0.37796		6.50739	
50 n-Butanol	+++++	+++++	+++++	+++++	+++++	+++++						
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00	<-
51 Trichloroethene	0.45675	0.42693	0.45327	0.46648	0.42197	0.44353						
	0.49084	0.43408	0.49843				AVRG		0.45470		5.89882	
52 1,2-Dichloropropane	0.29993	0.33159	0.32608	0.34190	0.30445	0.31520						
	0.34233	0.33119	0.34063				AVRG		0.32592		4.91405	
53 Methylmethacrylate	+++++	0.07080	0.05594	0.06027	0.06571	0.06279						
	0.06094	0.05778	0.06421				AVRG		0.06231		7.54312	
54 Dibromomethane	0.26123	0.26229	0.26475	0.26699	0.23347	0.23807						
	0.25757	0.26670	0.26155				AVRG		0.25718		4.91229	

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
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Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
55 Bromodichloromethane	0.73503	0.73954	0.74768	0.77164	0.68157	0.70223					
	0.76507	0.74711	0.76821				AVRG		0.73979		4.11138
56 2-Chloroethylvinylether	++++++	0.05154	0.04797	0.04890	0.04520	0.04520					
	0.04317	0.04683	0.05175				AVRG		0.04757		6.46721
57 cis-1,3-Dichloropropene	0.41825	0.39876	0.41296	0.42750	0.38040	0.39123					
	0.42473	0.42020	0.43691				AVRG		0.41233		4.48372
58 4-Methyl-2-pentanone	++++++	0.09507	0.09672	0.09723	0.08329	0.08874					
	0.09548	0.09975	0.09176				AVRG		0.09350		5.71038
60 Toluene	0.60226	0.58497	0.59374	0.61931	0.54607	0.58046					
	0.62588	0.57219	0.62753				AVRG		0.59482		4.58334
61 2-Nitropropane	+++++-	+++++	++++-+	+++++	-++++	+++++					
	+++++-	+++++	+++++				AVRG		0.000e-00		0.000e+00 <-
62 trans-1,3-Dichloropropene	0.31599	0.31872	0.33445	0.35051	0.29927	0.30399					
	0.33972	0.34006	0.34903				AVRG		0.32797		5.81097
63 Ethylmethacrylate	+++++	0.11142	0.11369	0.12377	0.13535	0.13120					
	0.12759	0.12576	0.13322				AVRG		0.12525		6.97146
64 1,1,2-Trichloroethane	0.16392	0.15889	0.17371	0.16551	0.14412	0.14718					
	0.16592	0.16972	0.16981				AVRG		0.16210		6.31635

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
65 1,3-Dichloropropane	0.36854	0.37107	0.36515	0.37481	0.33808	0.35075					
	0.38225	0.37432	0.39478				AVRG		0.36886		4.50645
66 2-Hexanone	------	0.07150	0.07445	0.07109	0.06770	0.06777					
	0.07451	0.07414	0.06606				AVRG		0.07090		4.76810
67 Tetrachloroethene	0.86088	0.80161	0.84414	0.85827	0.78173	0.83480					
	0.93478	0.78993	0.96445				AVRG		0.85229		7.33931
68 Dibromochloromethane	0.53503	0.55590	0.58011	0.59619	0.53894	0.57100					
	0.62497	0.59880	0.65252				AVRG		0.58372		6.67399
69 1,2-Dibromoethane	0.23518	0.27167	0.27311	0.28663	0.24757	0.25725					
	0.27435	0.29623	0.29859				AVRG		0.27118		7.90794
70 1-Chlorohexane	0.48997	0.47536	0.44715	0.49907	0.41264	0.46818					
	0.51309	0.48381	0.54273				AVRG		0.48134		7.80015
72 Chlorobenzene	0.85576	0.80956	0.85720	0.87158	0.79942	0.87161					
	0.94210	0.84654	0.95921				AVRG		0.86811		6.13347
73 1,1,1,2-Tetrachloroethane	0.52741	0.52750	0.56542	0.57635	0.51646	0.55315					
	0.59673	0.55336	0.58916				AVRG		0.55617		5.11310
74 Ethylbenzene	0.38364	0.37307	0.40174	0.41785	0.37536	0.41210					
	0.45129	0.38548	0.44326				AVRG		0.40487		7.07685

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2	
75 p,m-Xylene	1.16755	1.19484	1.27149	1.25418	1.18759	1.28827						
	1.39065	1.18161	1.34938				AVRG		1.25402		5.30362	
76 Bis(chloromethyl)ether	-----	+++++	+++++	+++++	+++++	+++++						
	-----	+++++	+++++				AVRG		0.000e+00		0.000e+00	<-
77 o-Xylene	1.13994	1.15963	1.23061	1.28216	1.16417	1.26993						
	1.37267	1.20564	1.33265				AVRG		1.23972		6.52515	
78 Styrene	0.65311	0.70816	0.75073	0.79335	0.72804	0.79263						
	0.86480	0.78067	0.84354				AVRG		0.76834		8.62834	
79 Bromoform	0.28834	0.31130	0.34148	0.35702	0.34405	0.36322						
	0.40291	0.38893	0.40591				AVRG		0.35702		11.23398	
80 Isopropylbenzene	2.27399	2.20527	2.24629	2.30692	2.09289	2.34273						
	2.58657	2.24702	2.60368				AVRG		2.32282		7.29593	
81 Cyclohexanone	+++++	+++++	+++++	+++++	++---	+++++						
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00	<-
83 1,1,2,2-Tetrachloroethane	0.43657	0.42727	0.40578	0.40261	0.35545	0.39328						
	0.42741	0.43417	0.42044				AVRG		0.41144		6.26108	
84 1,2,3-Trichloropropane	0.10070	0.10054	0.08646	0.09389	0.08134	0.08813						
	0.09736	0.09758	0.08740				AVRG		0.09261		7.54107	

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
85 Bromobenzene	0.75942	0.77071	0.76290	0.77424	0.70216	0.77446					
	0.85383	0.80967	0.76892				AVRG		0.77515		5.23380
86 trans-1,4-Dichloro-2-Butene	+++++	0.03598	0.02947	0.03574	0.03887	0.03518					
	0.03622	0.03805	0.04245				AVRG		0.03650		10.11905
87 n-Propylbenzene	2.67002	2.85506	2.92210	3.02259	2.71832	3.03598					
	3.34439	2.91153	3.09712				AVRG		2.97523		6.00619
88 2-Chlorotoluene	2.06028	1.86744	2.03085	1.97099	1.76922	2.00447					
	2.16191	1.96445	2.01258				AVRG		1.98247		5.67194
89 1,3,5-Trimethylbenzene	1.72278	1.73239	1.72990	1.80426	1.61606	1.81702					
	1.98369	1.75311	1.84998				AVRG		1.77880		5.76007
90 4-Chlorotoluene	2.09102	1.94569	1.95246	2.04200	1.83466	1.94938					
	2.27591	1.96579	1.95576				AVRG		2.00141		6.23045
91 tert-Butylbenzene	1.82692	1.67678	1.91538	2.00724	1.79659	1.99089					
	2.21448	1.92876	2.21230				AVRG		1.95215		9.21066
92 1,2,4-Trimethylbenzene	1.65587	1.62490	1.75102	1.75996	1.62594	1.82482					
	1.97584	1.75246	1.94087				AVRG		1.76796		7.21400
93 Pentachloroethane	+++++	0.24334	0.25184	0.28629	0.30415	0.30237					
	0.28397	0.28376	0.29823				AVRG		0.28175		8.04683

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
94 sec-Butylbenzene	2.69143	2.51869	2.62982	2.80647	2.47077	2.71842					
	3.12246	2.66180	3.24953				AVRG		2.76327		9.47143
95 1,3-Dichlorobenzene	1.30156	1.30754	1.31079	1.36057	1.22496	1.34802					
	1.46429	1.36115	1.50014				AVRG		1.35323		6.24168
96 p-Isopropyltoluene	2.10268	2.05188	2.15535	2.24666	1.98569	2.22047					
	2.46917	2.11859	2.52203				AVRG		2.20928		8.20819
98 1,4-Dichlorobenzene	1.43494	1.40251	1.39425	1.36747	1.23544	1.31770					
	1.43966	1.33189	1.56551				AVRG		1.38771		6.66404
99 n-Butylbenzene	2.21476	2.21542	2.37818	2.48919	2.18794	2.42739					
	2.78148	2.36333	2.90676				AVRG		2.44061		10.35554
100 1,2-Dichlorobenzene	1.02536	1.03912	1.07359	1.04563	0.94865	1.02475					
	1.12303	1.07860	1.20187				AVRG		1.06229		6.66212
M 101 Xylene (total)	1.13994	1.15963	1.23061	1.28216	1.16417	1.26993					
	1.37267	1.20564	1.33265				AVRG		1.23971		6.52515
102 1,2-Dibromo-3-Chloropropane	0.10405	0.09824	0.09214	0.09636	0.08348	0.09295					
	0.09981	0.10028	0.10382				AVRG		0.09679		6.72670
103 1,3,5-Trichlorobenzene	1.17769	1.21588	1.30646	1.35562	1.25911	1.39594					
	1.56258	1.41365	1.63729				AVRG		1.36958		11.19708

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
104 1,2,4-Trichlorobenzene	0.69744	0.75065	0.79571	0.87098	0.80932	0.89974					
	1.00256	0.96592	1.09149				AVRG		0.87598		14.53080
105 Hexachlorobutadiene	0.98296	0.99698	1.00786	1.07434	0.91201	0.98200					
	1.12483	0.97669	1.12439				AVRG		1.02023		7.09095
106 Naphthalene	0.42289	0.45627	0.53258	0.52375	0.49637	0.54304					
	0.59018	0.60250	0.59714				AVRG		0.52941		11.87856
107 1,2,3-Trichlorobenzene	0.59916	0.54913	0.61723	0.65010	0.60519	0.67045					
	0.72605	0.72550	0.79084				AVRG		0.65929		11.60118
108 2-Methylnaphthalene	4940	17529	49672	104078	239256	342848					
	502743	423108	1790527				POWER	0.90264	1.26765		0.99199
$ 38 Dibromofluoromethane	0.64499	0.61764	0.62672	0.70026	0.54032	0.60118					
	0.61854	0.63437	0.62478				AVRG		0.62320		6.70276
$ 43 1,2-Dichloroethane-d4	0.29013	0.33247	0.31658	0.36536	0.28278	0.30306					
	0.31106	0.32883	0.30427				AVRG		0.31495		7.90964
$ 59 Toluene-d8	0.88129	0.89456	0.90782	0.99599	0.79967	0.90462					
	0.93768	0.89943	0.95871				AVRG		0.90886		6.01438

INITIAL CALIBRATION DATA

Start Cal Date : 14-JAN-2000 14:45
End Cal Date : 19-MAY-2000 23:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/jun0100.b/25ml6w.m
Cal Date : 20-Jun-2000 12:07 kobusm

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
S 82 p-Bromofluorobenzene	0.84962	0.86357	0.87641	0.99470	0.79857	0.90913					
	0.92261	0.87937	0.85878				AVRG		0.88475		6.13626

Curve	Formula	Units
Averaged	Amt = Rsp/m1	Response
Linear	Amt = b + Rsp/m1	Response
Power	Amt = e^(b)*Rsp^(1/m1)	Response

CONTINUING CALIBRATION COMPOUNDS

Instrument ID: gcl6.i Injection Date: 01-JUN-2000 08:20
Lab File ID: oa601.d Init. Cal. Date(s): 14-JAN-2000 19-MAY-2000
Analysis Type: WATER Init. Cal. Times: 14:45 23:03
Lab Sample ID: VSTD010 Quant Type: ISTD
Method: /var/chem/gcl6.i/jun0100.b/25ml6w.m

	COMPOUND	RRF / AMOUNT	RF10	CCAL RRF10	MIN RRF	%D / %DRIFT	MAX %D / %DRIFT	CURVE TYPE
	1 Dichlorodifluoromethane	1.02976	0.80886	0.80886	0.010	-21.45137	100	Averaged
	2 Chloromethane	0.38472	0.35479	0.35479	0.100	-7.78195	100	Averaged
	3 Vinyl chloride	0.37081	0.33392	0.33392	0.010	-9.94809	20.00000	Averaged
	5 Bromomethane	0.42050	0.39800	0.39800	0.010	-5.35212	100	Averaged
	6 Chloroethane	0.15080	0.15730	0.15730	0.010	4.31025	100	Averaged
	7 Trichlorofluoromethane	0.77966	0.77263	0.77263	0.010	-0.90221	100	Averaged
	11 1,1-Dichloroethene	0.27281	0.24497	0.24497	0.010	-10.20430	20.00000	Averaged
	18 Methylene chloride	0.20933	0.16864	0.16864	0.010	-19.43909	100	Averaged
	21 trans-1,2-Dichloroethene	0.25391	0.20806	0.20806	0.010	-18.05668	100	Averaged
	24 1,1-Dichloroethane	0.50158	0.45345	0.45345	0.100	-9.59559	100	Averaged
	30 2,2-Dichloropropane	0.38372	0.36197	0.36197	0.010	-5.66762	100	Averaged
	29 cis-1,2-Dichloroethene	0.20119	0.24056	0.24056	0.010	19.56890	100	Averaged
	33 Bromochloromethane	0.12961	0.14953	0.14953	0.010	15.36933	100	Averaged
	36 Chloroform	0.70494	0.68533	0.68533	0.010	2.78228	20.00000	Averaged
	39 1,1,1-Trichloroethane	0.74174	0.63992	0.63992	0.010	-13.72690	100	Averaged
	40 1,1-Dichloropropene	0.45405	0.44691	0.44691	0.010	-1.57268	100	Averaged
	41 Carbon tetrachloride	0.80605	0.86176	0.86176	0.010	6.91138	100	Averaged
$	43 1,2-Dichloroethane-d4	0.31495	0.26689	0.26689	0.010	-15.26039	100	Averaged
	45 Benzene	0.77118	0.81266	0.81266	0.010	5.37920	100	Averaged
	44 1,2-Dichloroethane	0.33815	0.29345	0.29345	0.010	-13.22062	100	Averaged
	51 Trichloroethene	0.45470	0.50194	0.50194	0.010	10.38974	100	Averaged
	52 1,2-Dichloropropane	0.32592	0.34735	0.34735	0.010	6.57293	20.00000	Averaged
	54 Dibromomethane	0.25718	0.29322	0.29322	0.010	14.01323	100	Averaged
	55 Bromodichloromethane	0.73979	0.78366	0.78366	0.010	5.93002	100	Averaged
	57 cis-1,3-Dichloropropene	0.41233	0.38971	0.38971	0.010	-5.48512	100	Averaged
$	59 Toluene-d8	0.90886	0.74575	0.74575	0.010	-17.94641	100	Averaged
	60 Toluene	0.59482	0.53364	0.53364	0.010	-10.28542	20.00000	Averaged
	62 trans-1,3-Dichloropropene	0.32797	0.28540	0.28540	0.010	-12.97967	100	Averaged
	64 1,1,2-Trichloroethane	0.16210	0.13285	0.13285	0.010	-18.04210	100	Averaged
	67 Tetrachloroethene	0.85229	0.98718	0.98718	0.010	15.82761	100	Averaged
	65 1,3-Dichloropropane	0.36886	0.35899	0.35899	0.010	-2.67525	100	Averaged
	68 Dibromochloromethane	0.58372	0.72000	0.72000	0.010	23.34632	100	Averaged
	69 1,2-Dibromoethane	0.27118	0.30503	0.30503	0.010	12.48392	100	Averaged
	72 Chlorobenzene	0.86811	0.87817	0.87817	0.300	1.15930	100	Averaged
	73 1,1,1,2-Tetrachloroethane	0.55617	0.60929	0.60929	0.010	9.55030	100	Averaged
	74 Ethylbenzene	0.40487	0.38857	0.38857	0.010	-4.02531	20.00000	Averaged

CONTINUING CALIBRATION COMPOUNDS

Instrument ID: gcl6.i Injection Date: 01-JUN-2000 08:20
Lab File ID: oa601.d Init. Cal. Date(s): 14-JAN-2000 19-MAY-2000
Analysis Type: WATER Init. Cal. Times: 14:45 23:03
Lab Sample ID: VSTD010 Quant Type: ISTD
Method: /var/chem/gcl6.i/jun0100.b/25ml6w.m

	COMPOUND	RRF / AMOUNT	RF10	CCAL RRF10	MIN RRF	%D / %DRIFT	MAX %D / %DRIFT	CURVE TYPE	
	75 p,m-Xylene	1.25402	1.16048	1.16048	0.010	-7.45859	100	Averaged	
	77 o-Xylene	1.23971	1.15572	1.15572	0.010	-6.77544	100	Averaged	
	78 Styrene	0.76834	0.70516	0.70516	0.010	-8.22246	100	Averaged	
	79 Bromoform	0.35702	0.46571	0.46571	0.100	30.44384	100	Averaged	
	80 Isopropylbenzene	2.32282	2.08426	2.08426	0.010	-10.27032	100	Averaged	
$	82 p-Bromofluorobenzene	0.88475	0.95944	0.95944	0.010	8.44237	100	Averaged	
	85 Bromobenzene	0.77515	0.83965	0.83965	0.010	8.32107	100	Averaged	
	83 1,1,2,2-Tetrachloroethane	0.41144	0.47270	0.47270	0.300	14.88944	100	Averaged	
	84 1,2,3-Trichloropropane	0.09261	0.08743	0.08743	0.010	-5.59103	100	Averaged	
	87 n-Propylbenzene	2.97523	2.89079	2.89079	0.010	-2.83836	100	Averaged	
	88 2-Chlorotoluene	1.98247	2.06549	2.06549	0.010	4.18774	100	Averaged	
	89 1,3,5-Trimethylbenzene	1.77880	1.60911	1.60911	0.010	9.53971	100	Averaged	
	90 4-Chlorotoluene	2.00141	2.12572	2.12572	0.010	6.21109	100	Averaged	
	91 tert-Butylbenzene	1.95215	1.81856	1.81856	0.010	-6.84332	100	Averaged	
	92 1,2,4-Trimethylbenzene	1.76796	1.62492	1.62492	0.010	-8.09087	100	Averaged	
	94 sec-Butylbenzene	2.76327	2.58970	2.58970	0.010	-6.28132	100	Averaged	
	95 1,3-Dichlorobenzene	1.35323	1.41221	1.41221	0.010	4.35916	100	Averaged	
	96 p-Isopropyltoluene	2.20928	2.01969	2.01969	0.010	-8.58139	100	Averaged	
	98 1,4-Dichlorobenzene	1.38771	1.34923	1.34923	0.010	-2.77306	100	Averaged	
	100 1,2-Dichlorobenzene	1.06229	1.08646	1.08646	0.010	2.27525	100	Averaged	
	99 n-Butylbenzene	2.44061	2.32194	2.32194	0.010	-4.86200	100	Averaged	
	102 1,2-Dibromo-3-Chloropropane	0.09679	0.10989	0.10989	0.010	13.53568	100	Averaged	
	104 1,2,4-Trichlorobenzene	0.87598	0.88988	0.88988	0.010	1.58615	100	Averaged	
	105 Hexachlorobutadiene	1.02023	1.33411	1.33411	0.010	30.76586	100	Averaged	
	106 Naphthalene	0.52941	0.48568	0.48568	0.010	-8.26103	100	Averaged	
	107 1,2,3-Trichlorobenzene	0.65929	0.66261	0.66261	0.010	0.50382	100	Averaged	
	13 Acetone	9.55937	10.00000	0.03232	0.010	-4.40635	0.000e+00	Linear	<-
	14 Carbon Disulfide	0.76830	0.88191	0.88191	0.010	14.78628	100	Averaged	
	26 Vinyl Acetate	0.27060	0.20500	0.20500	0.010	-24.24296	100	Averaged	
	28 2-Butanone	0.02233	0.02512	0.02512	0.010	12.52682	100	Averaged	
	56 2-Chloroethylvinylether	0.04757	0.04888	0.04888	0.010	2.74380	100	Averaged	
	58 4 Methyl 2-pentanone	0.09350	0.08354	0.08354	0.010	-10.66761	100	Averaged	
	66 2-Hexanone	0.07090	0.06540	0.06540	0.010	-7.75718	100	Averaged	
	16 Acetonitrile	151	160	0.00390	0.010	-5.36630	0.000e+00	Linear	<-
	20 Acrylonitrile	138	160	0.01076	0.010	-13.86593	0.000e+00	Linear	<-

CONTINUING CALIBRATION COMPOUNDS

Instrument ID: gcl6.i
Lab File ID: oa601.d
Analysis Type: WATER
Lab Sample ID: VSTD010
Method: /var/chem/gcl6.i/jun0100.b/25ml6w.m

Injection Date: 01-JUN-2000 08:20
Init. Cal. Date(s): 14-JAN-2000 19-MAY-2000
Init. Cal. Times: 14:45 23:03
Quant Type: ISTD

	COMPOUND	RRF / AMOUNT	RF10	CCAL RRF10	MIN RRF	%D / %DRIFT	MAX %D / %DRIFT	CURVE TYPE	
	31 Propionitrile	0.00386	0.00568	0.00568	0.010	47.19076	100	Averaged	<-
	47 Crotononitrile	0.00564	0.00592	0.00592	0.010	4.99601	100	Averaged	<-
M	46 1,2-Dichloroethene (total)	0.22755	0.22431	0.22431	0.010	-1.42315	100	Averaged	
M	101 Xylene (total)	1.23971	1.15572	1.15572	0.010	-6.77544	100	Averaged	
	22 Methyl tert-Butyl Ether	0.22391	0.13770	0.13770	0.010	-38.50003	100	Averaged	
	10 Acrolein	0.00499	0.00373	0.00373	0.001	-25.28192	100	Averaged	
	35 Tetrahydrofuran	0.01417	0.01466	0.01466	0.010	3.42390	100	Averaged	
	70 1-Chlorohexane	0.48134	0.39412	0.39412	0.010	-18.12004	100	Averaged	
	103 1,3,5-Trichlorobenzene	1.36958	1.43757	1.43757	0.010	4.96438	100	Averaged	
	12 Trichlorotrifluoroethane	0.75429	0.77337	0.77337	0.010	2.52917	100	Averaged	
$	38 Dibromofluoromethane	0.62320	0.68726	0.68726	0.010	10.27996	100	Averaged	
	108 2 Methylnaphthalene	7.58518	10.00000	0.22434	0.010	-24.14823	0.000e+00	Power	<-

Target and Internal Standards

Pentafluorobenzene
Acetone
Acrolein
Acrylonitrile
Bromochloromethane
Bromomethane
2-Butanone
Carbon disulfide
Chloroethane
Chloroform
Chloromethane
Dichlorodifluoromethane
1,1-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
2,2-Dichloropropane
Iodomethane
Methylene chloride
1,1,1-Trichloroethane
Trichlorofluoromethane
Vinyl acetate
Vinyl Chloride

Chlorobenzene-d_5
Bromoform
Bromofluorobenzene (surrogate)
Chlorodibromomethane
Chlorobenzene
1,3-Dichloropropane
Ethylbenzene
2-Hexanone
Styrene
1,1,1,2-Tetrachloroethane
Tetrachloroethene
Xylene

1,4-Difluorobenzene
Benzene
Bromodichloromethane
Carbon tetrachloride
2-Chloroethyl vinyl ether
1,2-Dibromoethane
Dibromomethane
1,2-Dichloroethane
1,2-Dichloroethane-d_4 (surrogate)
1,2-Dichloropropane
1,1-Dichloropropene
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
4-Methyl-2-pentanone
Toluene
Toluene-d_8 (surrogate)
1,1,2-Trichloroethane
Trichloroethene

1,4-Dichlorobenzene-d_4
Bromobenzene
n-Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
2-Chlorotoluene
4-Chlorotoluene
1,2-Dibromo-3-chloropropane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Hexachlorobutadiene
Isopropyl benzene
p-Isopropyltoluene
Naphthalene
n-Propylbenzene
1,1,2,2-Tetrachloroethane
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene

Surrogate Spike Recovery Default Limits

Surrogate Compound	Water	Low Soil
Toluene-d_8	80-120	81-117
4-Bromofluorobenzene	80-120	74-121
1,2-Dichloroethane-d_4	80-120	70-121

LCS / MS Recovery Default Limits

MS Compound	Water	Soil/Sediment
1,1-Dichloroethene	61-145	59-172
Trichloroethene	71-120	62-137
Chlorobenzene	75-130	60-133
Toluene	76-125	59-139
Benzene	76-127	66-142

Internal standard areas must be within -50% to 100% of the EICP for the corresponding continuing calibration standards. Internal standard retention times must not deviate by 30%.

Attachment 3.

Example: GC/MS Volatiles/CAR Logbook; Tune Form; Sample Tracking Sheet

STL Chicago
GC/MS Volatile Analysis Logbook

Instrument ID# 3

CHI-22-20-001/E-9/00

Analysis Date / Time	File Name	Sample Number		Sample ID	Sparge No.	Sample Wt. / Vol.	Instr. Dil.	Int. Std. No.	pH < 2	Comments (MUST include SRN's)	Analyst Initials
		YYMM G XXX	XXX								

Analyst Signature/Date:_____ Reviewer Signature/Date:_____ Page No._____

STL Chicago

Instrument ID# 3 **Corrective Action/Qualification Report GC/MS VOA** Page No._____

CHI-22-20-001/E-9/00

Analytical Methods **Tune Name:**_____'00, '01

___SW846 8260/A/B ___EPA 524.2 __Other_____

___40CFR 624 ___OLM03.2

___OLM04.2 ___OLC02.1

ISTD/RT report

Initial calibration / Continuing Calibration IS#_____

(For method 524 include all points in ICAL)

Data File Name:_____

	IS 1	RT1	IS2	RT2	IS3	RT3	IS4	RT4
1								
2								
3								
4								

Tune Criteria

Description of Situation:_____

Action Taken:_____

Demonstration of Control:_____

Initial Calibration Cirteria

Description of Situation:_____

Action Taken:_____

Demonstration of Control_____

Continuing Calibration Criteria

Description of Situation:_____

Action Taken:_____

Demonstration of Control:_____

Internal Standards (continuing cal to continuing cal)

Description of situation:_____

Action Taken:_____

Demonstration of Control:_____

Method Blank

Description of situation:_____

Action Taken:_____

Demonstration of Control:_____

LCS

Description of Situation:_____

Action Taken:_____

Demonstration of Control:_____

Qualification of Data

Data Affected (Client/Sample #)_____

Qualification:_____

Associated samples reanalyzed: Yes No (see below)

Explanation for no reanalysis/data MUST be qualified and narrated:_____

Analyst Signature/date_____/_____

Reviewer Signature/date_____/_____

TUNE NAME:	TUNE TIME: GOOD UNTIL:	STD NAME:	INST:___
ICAL ☐ CCAL ☐ ISTD ☐ UPDATED ☐	METHODS:	BATCH NAME:	QC / ICAL REF # ☐

SPREADSHEET	TEST	RFWBATCH#	UP	PC

RFW /Client	Sample Type D1, R1, OO	Filename:	pH	List	Matrix	Hold Time	I S	S S	Miscellanous Infomation :	Q'Area Q'Del Add Unknowns	TICS Deleted	TICS Renamed	Get Infor from LIMS	Final Report Printed	Load to DBase

HEADER EDITED ☐ TUNE TIME ☐ DATA FILES PURGED ☐

Big Boards

METHODS:	LIST:		STL #	Client	Matrix	HT DATE	Filename	Dilution	Tune Name	Action	Analyst	Special Information
8260A 5ml/25ml												
8260B 5ml/25ml												
524	TICs:	5										
624		10										
OLM3.2/4.2		30										
25 ML OLM (PRC)		None										
OLC2.1/OLCPRC		R1/D1										
Other:_____												
	DELIVERABLES:											
SURROGATES:												
	STD											
In-House	CLP											
In-House-AFCEEB	CLP-Like											
Method / SOP												
Other												
	OTHER:											
SPIKES:	Cis/Trans - Separate											
	DCE (Total)											
Comprehensive 00	M/P Xylene											
Compreh - Not In House	O-Xylene											
PEASE	Xylene (Total)											
TCLP												
OLM												
524												
624	INCLUDE CARS											
OLC												
Other	STD TRACEABLILITY											
	NO J VALUES											
CONTROL COMPOUNDS												
TCLP	ADDITIONAL STDS											
624 Table 6 Limits												
524 All 80 - 120%	VIAL NUMBERS											
OLM Five Compounds												
8260A/B Five Compounds	Narrative											
OLC02.1 Compounds 60 - 140%												
AFCEE ALL (BS/BSD Out High if Target ND)												

CHI-22-20-031/C-5/00

Attachment 4.

Evaluation and Acceptance Criteria Table

GCMS Calibration – Evaluation and Acceptance Criteria

Prepare standards	• The concentrations must cover the range of quantitation for all analytes • The lowest point of the calibration curve must be at, or below, the reporting limit	
Run calibration standards	• All analytes must contain at a minimum 5 calibration points for Linear regressions, linear curves, or average response factors • Analytes using second order fits must have a minimum of 6 calibration points on a curve • Analytes using 3rd order curves must have a minimum of 7 calibration points	• Calibration levels deemed to be statistical or visual outliers shall be dropped from the curve and replaced by a similar concentration standard. The standard shall be dropped in its entirety, not on a per analyte basis
Calculate "grand mean RSD" of all compounds	• The "grand mean RSD" is calculated before attempting to fit compounds to any calibration curves only because it is easier to do at this time. The "grand mean RSD" acceptance is only to be used as a last resort in determining whether a compound's calibration is acceptable. • Calibrations for compounds which occur on different dates (i.e. appix compounds analyzed at different dates than the HSL compounds), the "grand mean RSD" is calculated separately for each curve.	• If no %RSD for any given compound is above 15%, the "grand mean RSD will be less than 15%.
Evaluation each compound for linear fit, second order fit or 3rd order fit	• Having determined that the calibration meets minimum requirements, the laboratory will evaluate each compound to determine the best calibration fit using statistical and visual evaluation of the curve. • Using "priori" knowledge some compounds ranges may be shortened (i.e. not as low a reporting limit or not as high a range)	• Citing priori knowledge the laboratory may decide to "keep" calibrations for several compounds despite exceeding the statistical threshold allowed by the method. The compounds that fall in this category are known poor performers as indicated by the method or as indicated from historical performance data (e.g. Appendix IX compounds). These compounds will be listed in the OP as possible trouble analytes. Quantitation for these compounds may be biased and should be used only with caution.
Determine the best calibration approach for each compound	• RRF • Linear • 2nd order • Grand Mean RSD	• Even when the "grand mean RSD" indicates minimum acceptance has been met, the analyst must use discretion for quantification because some compounds may be biased. This approach must be used with caution.

Attachment 5.

Example: Analysis and Sample Tracking Flowcharts

ANALYSIS SCHEME FLOWCHART

(Terms defined in the Section 9)

```
                PFTBA
                  |
                  |
                  |
                 BFB  (Form 5)
                /  \  Every 12 hours
               /    \
              /      \
Initial Calibration--------Continuing Calibration
   (Form 6)                (Form 7)
                      Every 12 hours
                          |
                          |
                          \|/
                       Analysis
                          |
                          |
                          \|/
                Computer Data Production/Reduction
                          |
                          |
                          \|/
                 Operator Data Review/Reduction
                     (Form 1,2,3,4,5)
                          |
                          |
                          \|/
                 Final Review/Data Submission
                          |
                          |
                          \|/
                    Report Generation
```

Sample Tracking Flowchart (for EACH unique Sample Batch #)

```
                    Sample Receipt
                          | \
                          |  \
                       Log-In    VOA Refrigerator
                      /   |       |
                     /    |       |
                    /     |       |
                   COC  Computer   |
                   |      |       |
                   |      |       |
                   |      |       |
                   |    Backlog   |
                   |      |       |
                   |\     |      /
                   | \    |     /
                   |  \   |    /
                   |   \  |   /
                   VOAs   VOAs
                   |      |
                   |      |
                  Filed   Posted
                    \     /
                     \   /
                      \/
                      Input
                       |
                  Sample Tracking Board
                       |
                       |
                     Analysis
                       |
                       |
                     OUTPUT:    COC, Tune Form, Oper. Anal. Logbook, Comp.
                          |Data Prod., Tune, Calibration, QC
                  ________|________
· Operator Review/Data Reduction                  · Archival (automated scheduled back-ups)
· Data Package w/ Review Form, CARs               · Tune Form filed
· 1st 100% Review                                 · Review Form, CAR copies filed
· Submission/Final Review                         · Data purged off system
          |_____________________________________________|
                          |
                  REPORT GENERATION
```

Attachment 6.

Example: Data Review Form

STL Chicago
GC/MS Volatiles Data Review Form

Client :_____ **Reviewer #1 :**_____ **Date :**_____
Sample# :_____ **Reviewer #2 :**_____ **Date :**_____
Target List :___O_____
Method :_____A__B__
QC Level /Deliverables : _____ **Narrative (If required) :**_____

Form 1/Associated Data

1	2	
___	___	Header information correct (FV, DF, data file, extraction weight/volume)
___	___	Verify correct flags for hits (E, B, J, D). **List dilutions below.**
___	___	Raw data matches Form1
___	___	Header information correct on target report (dil, weights, analyst initials present). **Manually calculate a concentration. (must be completed; see comments below)**
___	___	Signature and date present
___	___	Verify samples processed under correct method and correct quantitation was performed (ccal or ical used).
___	___	Spectra present of each positive hit (and negative spectra if required). Manual subtractions present if needed.
___	___	TIC report present if required.
___	___	Spectra present for each TIC reported.
___	___	Verify correct flagging of TIC's (J, B, N)
___	___	Remove TIC page and form 1E, F from package for blanks associated with spikes, redos or dilutions only. Remove same page for the samples as well (OLM01.8 exception).
___	___	**LIMS** : Verify hits, reporting limits and flags match from Form1 Envision (Targets AND TIC's) to LIMS summary and TIC's.
___	___	**COC :** Verify target list, deliverables with client COC/QAPP/etc.....CHECK THE PAPERWORK.

Comments :

Compound :
Sample # :
Calculation :

Form 2

___	___	Verify limits used with requirements of client, method, QAPP etc... (**Circle** : in-house, QAPP/COC, method/SOP) .
___	___	**Document below** re-analysis of outliers and outcome or document why CA was not taken.
___	___	Verify all samples in sample batch appear on Form 2.

Comments :

Form 3/Associated Data **MATRIX SPIKES**

___	___	Verify P/A limits used with requirements of client, method,QAPP etc (**Circle** : in-house, QAPP/COC, method/SOP, mixture)
___	___	**List** compounds outside limits. **List** controlled 5 (8260/CLP) separately. **Indicate** those within limits in the BS samples. For other methods, all are controlled as per method or SOP. Qualify data if necessary.

Comments :

Form 3/Associated Data **BS SPIKES**

1 2

___ ___ Verify P/A used with requirements of client, method, QAPP etc (**Circle** : in-house, QAPP/COC, method/SOP, mixture)

___ ___ **List** compounds outside limits. **List** controlled 5 (8260/CLP) separately. For all other methods all controlled as per method or SOP. **Verify** compounds ND in samples and BS out high for these methods. Qualify data is necessary.

Comments :

Form 4/ Associated Data

___ ___ Verify all samples appear on the Form 4.

___ ___ **Document** blank contamination by compound and level. Confirm "B" flags on Envision AND LIMS.

___ ___ **Document** TIC contamination and confirm "B" flags in both places also.

Comments :

Form 5/ Associated Data

___ ___ Verify all appropriate samples on the Form.

___ ___ Verify all within tune time. **List** any outside of clock and explanation for no CA.

___ ___ Verify all criteria met (for CLP, verify the appropriate processing method was used).

Comments :

Form 6, 7 / Associated Data

___ ___ Verify Form 6 present with correct data files used. Verify all initial calibration criteria are met by method or SOP. **Comment below**. **List** any outside limits and qualify date if needed. Verify all CCC's/SPCC's flags and flags for outliers appear.

___ ___ Verify average RF on Form 7 matches Form 6. Verify continuing calibration meets requirements. **Comment below. List** any outside limits and qualify data if needed. Verify all CCC's/SPCC's flags and flags for outliers appear.

___ ___ Verify CBCHK attached for method 624A (form 7 NA).

___ ___ Verify regression data attached if needed.

Comments :

Form 8

___ ___ Verify all samples appear on Form 8.

___ ___ Verify appropriate standard is being used.

___ ___ **List** outliers below and CA. **Explain** basis for no CA if applicable.

Comments :

Additional (If required)

___ Run logs

___ Extraction Logs

___ Raw Data ICAL

___ Standards Traceability

___ CARs

___ pH

___ NewChron (verify HT met)

___ RG LabChron/Report Review Initial/Date _____

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23 October 2002

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 2
Revised Pages for Volume 1

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached 2 copies of the Consent Order Plans and Reports (COPR), Volume 2. The plans provided in Volume 2 include:

- Quality Assurance Project Plan (QAPP)
- Sampling and Analysis Plan (SAP)
- Health and Safety Plan (HASP)

Two copies of the COPR, Volume 1, were submitted to the U.S. EPA on 9 October 2002. The plans that were provided in Volume 1 included:

- Project Management Plan (PMP)
- Data Management Plan (DMP)
- Community Relations Plan (CRP)
- Institutional Control Plan (ICP)

The submission of Volumes 1 and 2 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b, Section VI, Paragraph 15; and Section 2 and Table 1 of Attachment 2 of the Consent Order. The remaining plans and reports will be submitted to the U.S. EPA in subsequent volumes.

Weston Solutions, Inc. (WESTON®) received comments on the COPR, Volume 1, from the U.S. EPA on 21 October 2002. Two copies of responses to the comments and revised pages for the COPR, Volume 1, are attached to this letter. These revised pages replace the original pages of the respective plans.

If you have any questions or comments regarding this submittal, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas S. Cornuet

Thomas S. Cornuet
Project Manager

Attachment

cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON

Sampling and Analysis Plan
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

October 2002

Prepared for

WYETH
Florham Park, New Jersey

Prepared by

WESTON SOLUTIONS, INC.
1400 Weston Way
P.O. Box 2653
West Chester, Pennsylvania 19380

W. O. No. 02994.002.009

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LIST OF ACRONYMS

AHP	American Home Products Corporation
CMI	Corrective Measures Investigation
CMS	Corrective Measures Study
COPR	Consent Order Plans and Reports
DCE	Dichloroethene
GAC	Granular Activated Carbon
ICP	Institutional Control Plan
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SVE	Soil Vapor Extraction
TCA	Trichloroethane
TCE	Trichloroethene
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WKI	World Kitchen, Incorporated

1. INTRODUCTION

1.1 PLAN OBJECTIVES

The Sampling and Analysis Plan (SAP) for the Massillon, Ohio World Kitchen, Inc. (WKI) plant (U.S. EPA ID No. OHD 045-205-424) has been prepared to fulfill reporting requirements set forth in Section VI, Paragraph 15, Section IX, Paragraph 39b, and Section 2 and Table 1 of Attachment 2 of the Administrative Order on Consent (Consent Order) between the United States Environmental Protection Agency (U.S. EPA), WKI, and Wyeth (August 2002). This Plan is based on guidance provided in the following:

- U.S. EPA, Region 5, Resource Conservation and Recovery Act (RCRA) Quality Assurance Project Plan (QAPP) Instructions (April 1998).
- WKI, Massillon, Ohio Facility Consent Order (August 2002) Scope of Work.

The purpose of this SAP is to provide detailed step-wise procedures for environmental media sampling and supplementary measurements conducted in the field. Detailed laboratory procedures and other project quality assurance/quality control (QA/QC) guidance are provided in the QAPP provided in the Consent Order Plans and Reports (COPR), Vol. 2.

1.2 FACILITY OWNERSHIP

EKCO Housewares, Inc. owned and operated the Massillon, Ohio, facility until 1965, at which time it was acquired by American Home Products Corporation (AHP). AHP continued to operate the facility until 1984 when it was sold to the EKCO Group. In 1999, the EKCO Group sold the facility to WKI, the current owner of the property. AHP changed its name to Wyeth in March 2002.

1.3 FACILITY DESCRIPTION

The facility occupies approximately 13 acres in the City of Massillon, Stark County, Ohio (Figure 1-1). The area surrounding the site is largely urban and industrial. Land use to the northwest is more rural with more open space. The property is triangular in shape and lies approximately 1,500 ft west of the Tuscarawas River. The facility is bordered to the north by

FIGURE 1-1 SITE LOCATION MAP
WORLD KITCHEN, INC. (EKCO) FACILITY
MASSILLON, OHIO

Newman Creek, while the Penn Central and the Baltimore and Ohio Railroads border the property to the west and east, respectively. The Baltimore and Ohio Railroad has numerous spurs and sidetracks adjacent to the plant, which are used for the storage of rail cars and track maintenance vehicles.

Manufacturing, warehousing, and shipping activities are conducted within a complex of interconnected buildings, which cover approximately 5.6 acres of the 13-acre site. The buildings are subdivided into office space, warehouses, machine shops, coating process lines, and packaging and shipping areas. The building locations are shown on Figure 1-2.

A variety of businesses operate in the immediate vicinity of the plant, including: Ohio Packaging (paper supplier) to the south, sand and gravel quarries to the west and northwest, Carter Lumber (retail) and Price Brothers, Inc. (concrete pipe) to the north, and the Consumer Water Service (public water supply) waterworks and an automobile reclamation site to the east and northeast. An inactive municipal landfill reportedly exists just east of Consumer Water Service. The City of Massillon is believed to have been the principal user of the landfill; however, other users may also have been involved. The landfill was apparently informally operated, that is, no weigh station or access control was believed to have been present, and the landfill was not fenced. It is unclear whether records of ownership, methods of operation, or methods of "closure" have been retained.

1.4 FACILITY HISTORY

The first recorded activities occurred at the facility in approximately 1929, when the property was owned by Standard Oil Company. From approximately 1929 to 1942 Fort Pitt/Massillon Bridge Works manufactured iron and steel bridges and structural iron. In 1945, the Massillon facility was manufacturing aluminum and stainless steel cookware. By 1951, with the United States' involvement in the Korean Conflict, the plant was manufacturing 90 mm and 105 mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells, W-1 and W-2, at the facility (Figure 1-2). In 1953, a sewer was constructed which carried the plant waste to a discharge point along Newman Creek. At approximately the same time, a surface impoundment was constructed along the northern property boundary

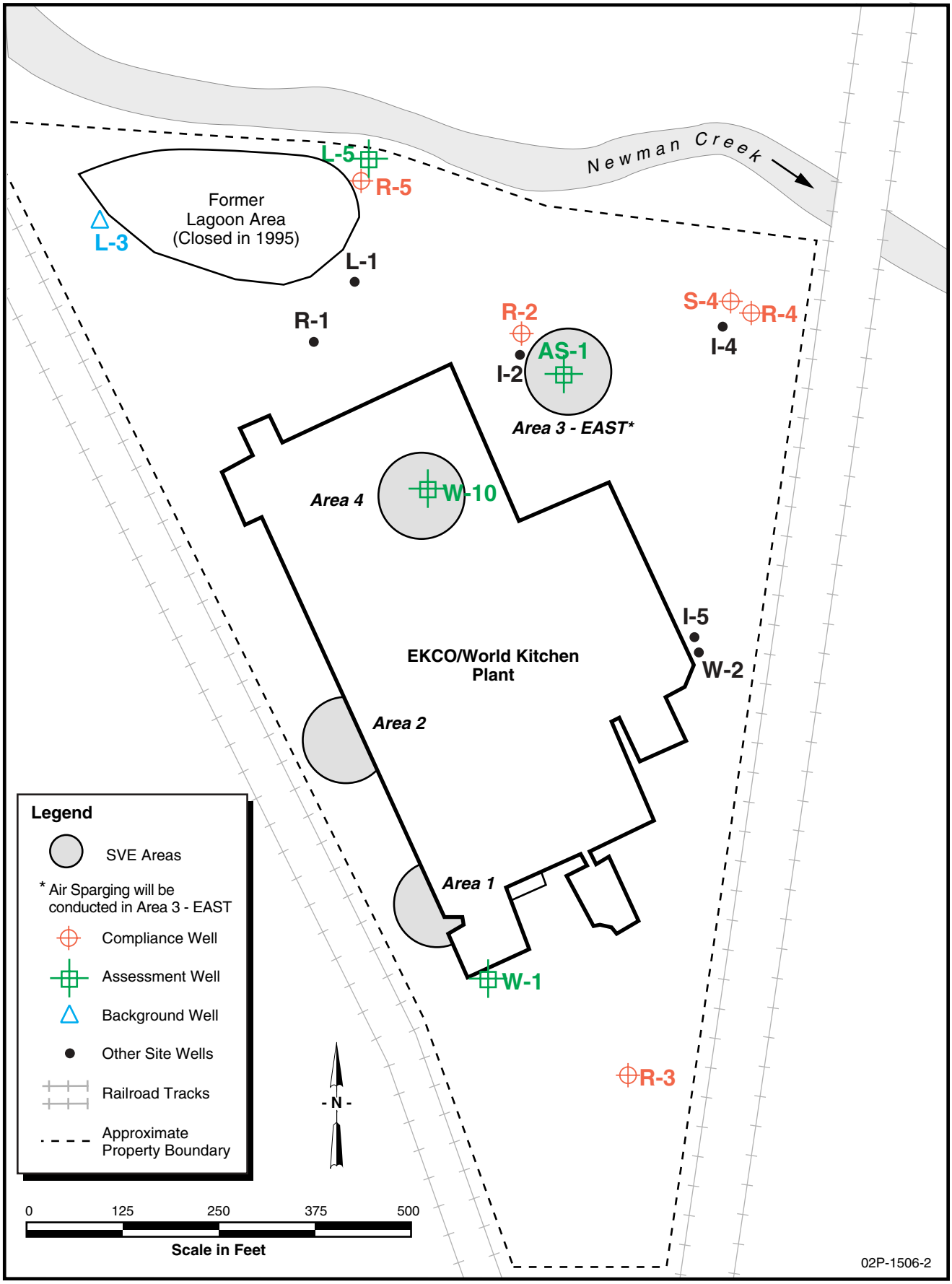

FIGURE 1-2 WORLD KITCHEN, INC. - MASSILLON, OHIO PROJECT GROUNDWATER MONITORING PROGRAM WELLS AND SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING AREAS

adjacent to Newman Creek. Wastewaters from manufacturing were discharged to the surface impoundment.

During 1954, the facility began alternate manufacturing operations. The primary function of these operations was returned to manufacturing cookware at the facility. Solvents (primarily trichloroethene [TCE] or 1,1,1-trichloroethane [1,1,1-TCA]) were used to clean the products prior to continuing production. These solvents were used for cleaning purposes until 1994. In 1994, the solvents were replaced with a Borax aqueous cleaner which is still used at the facility. No chlorinated solvents have been used at the facility since 1994.

By 1967, trends in the cookware manufacturing industry had changed, resulting in the installation of porcelain- and Teflon-coating units. In 1969, with the development of new NPDES regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to accept waste products associated with plant activities. These waste products have included:

- Deionizers from plant operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain-Teflon-coated aluminum cookware (aluminum frit, various coloring inorganics oxides, lead, cadmium, selenium, cobalt).
- Alkaline washer fluids to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued for the facility. As the 1970's progressed, the facility discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper-coating operations had ended and the principal products manufactured at the facility became pressed and coated non-stick bakeware.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the Corrective Measures Study (CMS). This correction is based on more recent review of historical plant documents.

The surface impoundment was reactivated in 1980 under the existing NPDES permit, and received housing degreaser filter water until mid-1984. The surface impoundment was finally

decommissioned in December 1985. In March 1984, when the plant applied for a renewal of their NPDES permit, analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at the facility. The waste stream was diverted from the surface impoundment to discharge in Newman Creek in December 1985. At that time, the surface impoundment (lagoon) was permanently taken out of service.

In 1992, the facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area. During 1993 and 1994, Roy F. Weston, Inc. (WESTON®) was retained by AHP to pursue a clean closure for the lagoon. Closure activities were conducted at the site from August 1993 to June 1994. A closure certification report was submitted to the OEPA in July 1994, and approval of the lagoon closure was issued in January 1995. Now that the lagoon is officially closed, quarterly groundwater sampling of the lagoon wells is no longer required for the RCRA lagoon closure.

WKI (formerly EKCO) continues to manufacture pressed and coated non-stick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface. A detailed description of the historical environmental investigations and a table summarizing the facility history are provided in the Community Relations Plan COPR.

1.5 CONTAMINANTS OF CONCERN

1.5.1 Soil Contamination

The most recent soil sampling program was performed at the facility on 20 through 22 September 2000. Since the previous soil sampling program was completed 9 years earlier, it was anticipated that the concentrations of target VOCs at the site might have decreased due to natural attenuation. Therefore, it was decided that additional subsurface soil sampling was necessary to both confirm and delineate the extent of target VOCs in the proposed remediation areas at the site (shown in Figure 1-2). The target VOCs at the site include TCE, 1,2-dichloroethene (DCE), 1,1-DCE, and 1,1,1-TCA.

Soil borings were completed at 19 locations across the site (Figure 1-3). The soil boring locations were selected on the basis of results obtained from previous borings drilled in 1988 and 1991, and also on requests made by the U.S. EPA.

The soil analytical results were compared with the site soil performance standards shown in Table 1-1 below:

Table 1-1

Soil Performance Standards

Contaminant	Performance Standard (µg/Kg)
TCE	230
1,2-DCE	1,500
1,1-DCE	120
1,1,1-TCA	6,140

The highest detected levels were found under the northwest portion of the facility beneath the building foundation. The building's concrete floor slab currently prevents human exposure to any soil contamination located beneath the building. Soil remediation measures have been approved by the U.S. EPA and will be put in place in 2002 to treat the VOC-contaminated soil.

1.5.2 Groundwater Contamination

Groundwater sampling was conducted at the EKCO site in December 1988, September 1991, and March 1992. In addition to these three sampling events, selected wells were sampled quarterly from 1989 to 1995 as part of the lagoon closure plan for the site. Groundwater samples have been collected semiannually since 1995, with the most recent sampling event occurring in February 2001. Groundwater sampling will be conducted quarterly beginning in November 2002, under the new Consent Order executed in August 2002.

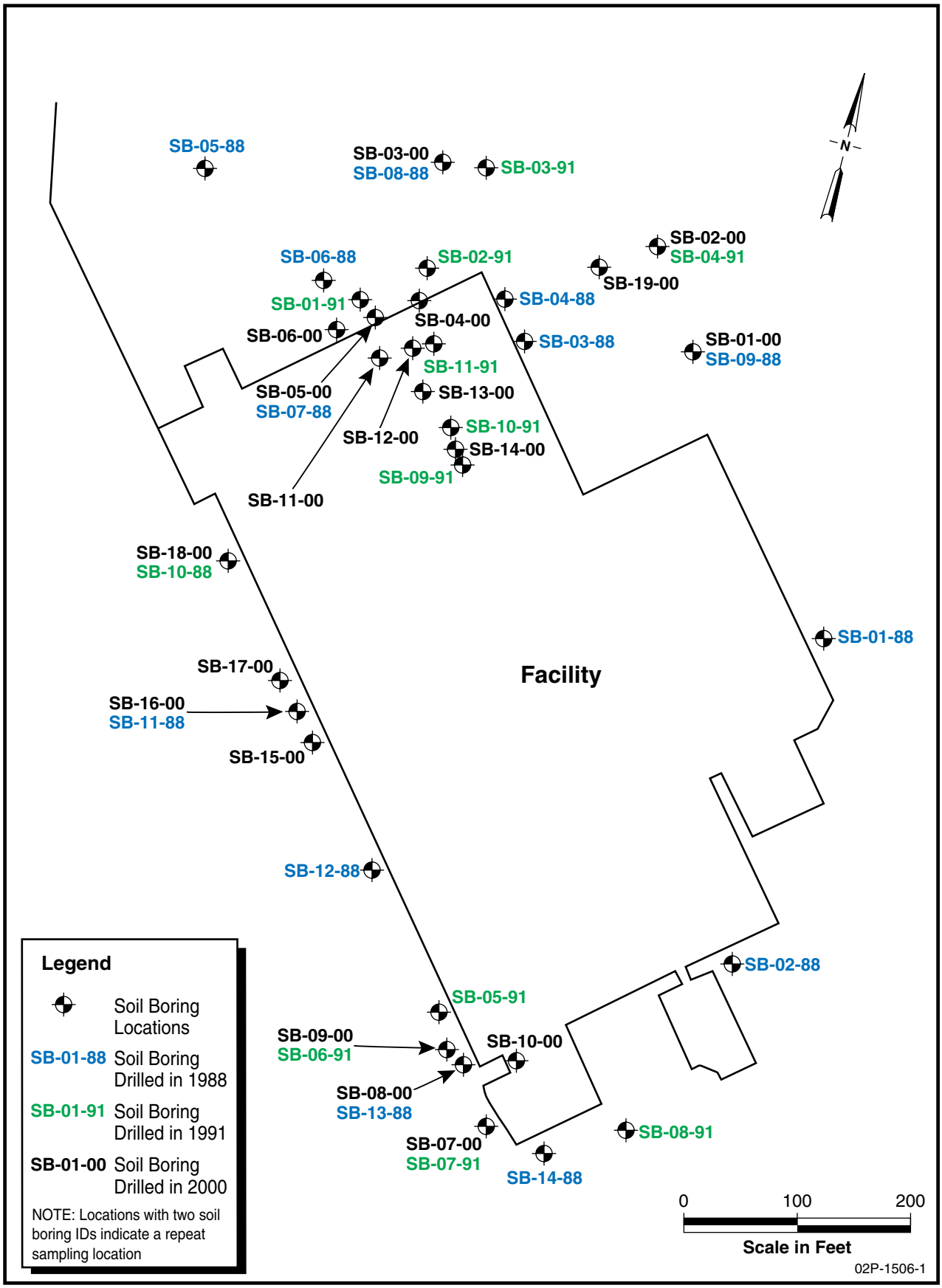

FIGURE 1-3 1988, 1991, AND 2000 SOIL BORING LOCATIONS

The VOCs detected in groundwater are predominantly TCE, 1,1,1-TCA, and their respective breakdown products, including 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. Maximum Contaminant Levels* (MCLs) for these contaminants are shown in Table 1-2 below:

Table 1-2

Maximum Contaminant Levels (µg/L)

Contaminant	Performance Standard
1,1-DCE	7
cis-1,2-DCE	7
Trans-1,2-DCE	100
1,1,1-TCA	200
TCE	5
Vinyl chloride	2

*These MCLs are used for the purpose of this analysis, even though there is no current or reasonably anticipated use of on-site groundwater for drinking purposes.

The results of recent well sampling show that MCLs were only exceeded for four compounds in the wells sampled: TCE, cis-1,2-DCE, vinyl chloride, and 1,1,1-TCA. A review of the historical data for these three analytes shows that the concentrations are generally decreasing, with the detected concentrations in the monitor wells either below or approaching their respective MCLs. Groundwater in the water-bearing zones is currently contained on-site and any VOCs that exist in the groundwater at the site are being recovered by the site production/recovery wells W-1 and W-10 and are being treated by an on-site air stripper system.

The highest contaminant concentrations at the site were detected in production/recovery wells W-1 and W-10, and results of the September 2002 samples collected from these wells are summarized below:

Contaminant (µg/L)	**W-1**	**W-10**
TCE	34	90
1,1-DCE	<5	<5
1,2-DCE (cis)	13	95
1,2-DCE (trans)	<5	<5
Vinyl chloride	<1	<1
1,1,1-TCA	21	280

2. UTILITY CLEARANCE

Prior to the initiation of intrusive fieldwork activities, the proposed soil boring and monitor well locations will be staked so that WKI and the Ohio Utility Protection Service (1-800-362-2764) can complete the utility clearance. The Facilities contact for utility clearance is Mr. Jeff Burman who can be reached by telephone at 330-832-5026. WESTON personnel will contact the Ohio Utility Protection Service and WKI prior to conducting intensive field activities. In addition, all field personnel will be familiar with appropriate WESTON health and safety and waste handling procedures.

3. SOIL SAMPLING PROGRAM

The soil remediation program recommended in the 1993 Final Corrective Measures Study (CMS) for the facility was soil vapor extraction (SVE) in three areas (Area-1, Area-2, and Area-3) outside the building (CMS Alternative OS-3) and one area (Area-4) inside the building (CMS Alternative IS-2). However, recent soil investigations conducted in September 2000 have shown that soil remediation is no longer needed in one of the areas outside the building (Area-3) and that soil remediation is needed in an area not identified in the CMS (WESTON, 2001). The recently identified area requiring soil remediation is east of Area-3 and is designated Area-3 East. The soil remediation areas are shown in Figure 1-2.

The operation and maintenance (O&M) procedures for the soil remediation program will be described in the O&M Plan (COPR, Vol. 4). Wyeth will document the ongoing O&M activities in the quarterly progress reports. The soil remediation monitoring will include sampling off-gas from the SVE vent system and collecting confirmation soil samples from the SVE remediation areas. The SVE off-gas and confirmation soil sampling procedures are described in the following sections.

3.1 SVE SYSTEM AIR SAMPLING

SVE off-gas samples will be collected from the SVE systems in each of the remediation areas for both field screening and/or laboratory analysis. These data will be used to evaluate system performance, optimization, maintenance, and termination. The SVE off-gas sampling data will also be used to determine when to collect subsurface soil confirmation samples from each of the remediation areas.

Field screening readings of the SVE off-gas will be collected from the well head locations using an organic vapor monitor (OVM) photoionization detector (PID), with an 11.7 electron-volt (eV) probe. Off-gas readings will also be collected at the manifold header for each SVE system, as well as at the blower discharge and treatment system. Prior to collecting the air monitoring data, field personnel should ensure that the monitoring equipment has been warmed up and properly calibrated according to manufacturer's procedures.

Since the SVE lines are under a vacuum, inserting the tip of the OVM directly into the sample port will not provide an accurate measurement. As a result, a vacuum pump or similar device will be necessary to extract a sample of the off-gas stream for OVM measurement. In order to install the vacuum pump, screw a barbed ball valve into the sample port and connect the barbed end to the vacuum end of the pump via Tygon tubing. Before turning the vacuum pump on, field personnel should ensure that the ball valve is in the "open" position. Turn the pump on to allow the line to purge. The discharge end of the pump should be similarly connected to a Tedlar bag (or other appropriate sample container) to receive the off-gas slip stream. After collecting the sample, disconnect the Tedlar bag from the vacuum pump. The OVM reading can then be taken by inserting the tip into the Tedlar bag.

In addition to field screening measurements, chemical concentration data periodically will be collected from the SVE well head manifold, and at locations downstream of the SVE system blowers, for laboratory analysis, as needed. These samples will be analyzed, at a minimum, for the four target constituents listed in Table 1-1 (Page 1-7). Sampling frequency will be determined by field conditions, permit requirements, and other considerations and will be described in the O&M Plan (COPR, Vol. 4) for the SVE system. Laboratory air samples will be collected via a Summa or other vacuum-type canister, and shipped to a qualified laboratory for analysis.

Air samples will be collected in vacuum canisters from the sample ports used for collecting the SVE field data parameters. The air canisters will be prepared and delivered to the site by the laboratory performing the analysis. Prior to sample collection, field personnel should measure and record the initial pressure of the canister. This is done to verify that no leaks have occurred during shipment of the canisters and for the laboratory to determine the total mass of the air sample, via the pressure differential in the canister. Pressure gauges fitted for the sample canisters may be supplied by the laboratory, along with the initial canister pressures at the time of preparation. Any significant deviations between the laboratory-reported pressure readings and those measured in the field should be reported to the laboratory, and the canister should be returned unused.

To collect the air sample, first open the port and attach tubing. Allow tube to purge. Attach the sample canister to the tubing. Connect the tubing to the sample canister according to the provided laboratory instructions, making sure that the canister valve remains tightly closed during the entire connection process. To begin sampling, open the valve very slowly until a slight "hissing" sound can be heard, indicating that the off-gas stream is entering the sample vessel. When the hissing sound can no longer be heard, the canister pressure has equalized with the pressure in the line, indicating that the sample collection process is completed. Completely open the canister valve to ensure complete filling of the canister, then close the canister valve tightly. Disassemble the device components in reverse order of the procedure described above, and return the threaded plug to the sample port.

3.2 SOIL CONFIRMATION SAMPLING

Soil confirmation sampling will consist of advancing three soil borings spaced evenly throughout each SVE remediation area using one of the methods described in Section 3.4. Two soil samples will be collected from each soil boring: one from the midpoint which is defined as halfway between ground surface and the bottom of the deepest SVE well in that area; and one from the soil interval with the maximum OVM screening level.

Soil Sampling Procedures

Soil samples will be collected and analyzed using EPA Method 5035 (Appendix A) for volatile organics in soil. This method requires collecting three 5-gram samples of soil at each sample point using an Encore, or equivalent, sampling device. The samples must be collected as soon as possible after extraction and with a minimum of disturbance of the soil to minimize the loss of any volatile constituents. Clean nitrile gloves will be worn during sample collection to avoid inadvertent contamination of the sampled material. Two replicates will be collected from each sampled interval to allow sufficient sample for reanalysis. These samples should be collected at the same time and as close as possible to the original sample.

Samples will be clearly labeled with the date and time collected and a unique sample ID number and sealed in an airtight bag or container. After labeling, all samples will be immediately placed

in an ice-filled cooler. The samples must be shipped in a cooler at 4°C to the contract laboratory so that sample extraction or preservation can be completed within 48 hours of collection.

3.3 SOIL SAMPLE IDENTIFICATION PROTOCOL

A unique field sample identification code will be assigned to each sample collected. For soil samples, the identification codes will consist of the following five parts separated by hyphens:

Sample Identification Code

Part 1		Part 2		Part 3		Part 4		Part 5
XXXX	-	XX	-	XX	-	XXXXXX	-	XX
Location Identification	-	Start Depth Identification	-	End Depth Identification	-	Collection Date Identification	-	Sample Type Identification

Location Identification

The *Location Identification Code* will not exceed four characters in length. Location identification codes will be unique identifiers consisting of character codes that describe the sample type and location. Please note that numbers 1-9 shall be written as two-dig numbers (i.e., 01-09).

Collection Date

The *Collection Date* portion of the sample identification code will not exceed six characters in length. The six-character date code will be:

MMDDYY

-MM—signifies a two-digit numeric code representing the month the sample was collected (01=January, 02=February, 03=March, 04=April, 05=May, 06=June, 07=July, 08=August, 09=September, 10=October, 11=November, 12=December).

-DD—signifies a two-digit numeric code representing the day the sample was collected. Valid values will include numbers from 01 to 31.

-YY—signifies a two-digit numeric code representing the year the sample was collected (i.e., – 02= 2002, 03=2003, etc.).

Sample Type

The *Sample Type* will be a two-digit number representing the sample quality control (QC) type. Table 3-1 lists and describes the possible QC types.

Table 3-1

QC Codes and Descriptions

QC Code	Description
01	Normal Sample
02	Field Duplicate Sample
03	Equipment Blank Sample
04	Trip Blank Sample

Start Depth or End Depth

Sample depth information for soil samples will be included in the *Sample Identification Code*. The starting and ending depths of a sample will be expressed in feet, separated by a hyphen (e.g., 02-04 represents a starting depth of 2 feet and an ending depth of 4 feet). All depths shall be rounded to the nearest whole number. No decimal points are to be used in the sample identification code.

3.4 SOIL BORING PROCEDURES

Subsurface soil samples will be collected using either hollow-stem auger or Geoprobe methods.

Hollow-Stem Auger Method

Hollow-stem auger drilling method may be used to collect lithologic data soil and analytical samples for soil borings that must be advanced to relatively deep target zones or into compacted or consolidated material. Soil samples will be collected from the soil boring using a standard 2-in. diameter, 2-ft long, split-spoon sampler. The borehole will be completed by advancing a

decontaminated split-spoon sampler followed by the hollow-stem auger, which will be used to maintain an open borehole.

Each split-spoon sampler will be scanned with an OVM to help document site conditions and select samples for potential analysis. Other field observations such as staining and odor will be used to designate sample intervals for any potential analysis. Samples for VOC analysis will be collected directly from the split-spoon samplers using an Encore, or similar, approved sampling device and placed into labeled, clean, laboratory-prepared sample containers. The samples will be collected and prepared according to US EPA Method 5035 (Appendix A). The sample identification number and sampling depth will be noted on the logging form (Appendix B).

Geoprobe® Method (Direct Push Method)

The Geoprobe® direct push drilling method may be used to collect soil analytical samples and lithologic data for soil borings where the boring target depth can be reached with this method. Continuous soil samples will be collected from each soil boring using a Geoprobe® macrosampler. The macrosampler is a 2-in. diameter, 4-ft long, steel cylinder that is fitted with a 2-in. diameter, 4-ft long, acetate liner that holds the soil sample. The following is a summary of the procedures used to collect a soil sample with a Geoprobe® rig:

- Insert a clean dedicated acetate liner into a clean macrosampler.
- Advance the macrosampler 4 ft with a hydraulic hammer.
- Remove the macrosampler from the borehole and unscrew the shoe from the tip of the macrosampler.
- Pull the acetate liner from the macrosampler.
- Place the acetate liner on a surface covered with visqueen.
- Slice open the acetate liner with a utility knife.
- Scan the sample, while in the acetate liner, with an OVM.

VOC samples will be collected directly from the acetate liner using an Encore, or similar, sampling device and placed into labeled, clean, laboratory-prepared sample containers. The

samples will be collected and prepared according to US EPA Method 5035 (Appendix A). The sample identification number and sampling depth will be noted on the logging form.

3.5 SOIL BORING ABANDONMENT PROCEDURES

Soil borings will be abandoned using the following procedures:

- Grout the boring using a cement/bentonite (20:1) grout mixture from the bottom of the borehole to the ground surface; or by pouring bentonite chips (hole plug) into the open boring until it is filled with bentonite. The bentonite chips will then be hydrated using water from the approved water source.
- The grouted borehole will be checked after grouting to determine if the grout has subsided. If so, additional grout will be placed in the hole to the ground surface.

A record of the abandonment procedure will be kept in the geologist's/soil scientist's logbook and will include the following information:

- Soil boring designation.
- Diameter and total depth of the borehole.
- Depth to water level (if any) in the borehole prior to grouting.
- Quantity of grout used.
- Date(s) of grouting.

4. MONITOR WELL PROGRAM

This subsection provides methods for installation, development, and sampling of monitor wells.

4.1 MONITOR WELL INSTALLATION

Each well will be advanced using hollow-stem auger (HSA) drilling methods and an 8-in. inside diameter (or other appropriate design) augers. Other drilling methods such as cable tool or air rotary may be used if conditions warrant. The installation procedures are as follows:

- Drilling and construction materials will be steam cleaned prior to use at a designated decontamination area. An on-site source of potable water will be used for steam cleaning, where available.
- Each monitor well boring will be advanced using HSA drilling and split-spoon sampling techniques or other drilling technique, as appropriate. The borehole will be continuously split-spoon sampled according to ASTM D-1586 procedures until then designated total depth is reached.
- Each well will then be constructed by installing a 10-foot length of manufactured 4-inch diameter, 10-slot (0.01-inch), rigid Schedule 40 PVC screen with bottom cap across the water-bearing zone of interest. The Schedule 40 PVC riser pipe will extend from the top of the screen to approximately 2 feet above grade (unless a flush-mount construction is required) and will be coupled to the screen using threaded joints.
- The annulus around the screen will be filter-packed with bagged clean, chemically inert, well-sorted, medium-grained sand from the base of the borehole to 2 feet above the top of the screen. The filterpack will be gravity placed. A 2-foot thick bentonite pellet seal will then be emplaced in the annulus above the sandpack followed by a 4% bentonite/cement (Portland Type 1 cement) slurry tremie grouted to ground surface. Potable water will be used to create the slurry. The well installation will be completed by installing a locking steel protective casing within a 2x2 feet cement pad. A weep hole will be drilled into the outer casing to provide drainage.

4.2 MONITOR WELL DEVELOPMENT

Following completion of drilling, each well will be developed using a decontaminated submersible pump. The wells will be purged until indicator parameters (pH, specific

conductance, redox potential [Eh], and dissolved oxygen [D.O.]) stabilize as defined here:

- pH: ±0.1 unit
- Specific conductivity: ±3%
- Eh: ±10 milliVolts (mV)
- D.O.: ±10%

Turbidity will be measured during well development, but will not be used to determine if the well is developed. If stabilization is achieved for the other parameters listed here and not for turbidity within a reasonable time (2 hours of continuous pumping), well development will be considered complete.

Reverse-circulation air lifting will be used when excessive amounts of sediment have entered the borehole. Reverse-circulation methods have been used successfully in the past in wells containing voids and clay-filled solution cavities. Because reverse circulation air-lift methods avoid forcibly exposing the annular space to air, reverse-circulation tools can be run throughout the entire water column in the wells being developed.

4.3 GROUNDWATER SAMPLING STRATEGY

The goal of the groundwater monitoring program is to monitor the progress of groundwater remediation and establish the basis to determine its completion.

The monitor wells that will be sampled, as part of the groundwater monitoring program are classified into three categories: compliance wells, assessment wells, and background wells. Compliance wells are used as "compliance points." The compliance wells will be used to compare groundwater contaminant concentrations to the groundwater performance standards to determine if remediation is complete. Assessment wells will be used to assess groundwater remediation system progress and to determine if changes are needed in recovery well pumping rates, air sparging flow rates, and pulse pumping schedules. The background well will be used to monitor background (upgradient) conditions. The compliance, assessment, and background wells

to be used in the groundwater monitoring program (Figure 1-2) are:

- Shallow Zone: Well L-3 (background), Wells L-5 and AS-1 (assessment), Well S-4 (compliance).
- Bedrock Zone: Wells R-2, R-3, R-4 and R-5 (compliance).
- Bedrock Zone Production/Recovery Wells: Wells W-1 and W-10 (assessment).

The groundwater monitoring program consists of quarterly sampling of the compliance, assessment, and the background wells for VOCs. In addition, the following site wells: W-2, I-2, I-4, I-5, L-1, and R-1, or some subset of these wells, will be sampled for two consecutive quarterly sampling events to show no groundwater performance standards are exceeded in these wells before the groundwater pump and treat system can be discontinued. The samples will be analyzed for the site-specific target compounds listed in Table 1-2.

4.4 GROUNDWATER SAMPLING PROCEDURES

To address the potential heterogeneous nature of the hydrogeological conditions at the site and the objectives of each investigation, two groundwater sampling techniques are described below: low-flow purging and sampling (Type I), and conventional purging and sampling (Type II). However, at this time it is anticipated that all groundwater samples will be collected using the conventional (Type II) sampling techniques.

The Type I sampling technique will be used in the following situations:

- In wells where only one discrete water-producing zone is encountered.
- In wells with no discrete water-bearing flow zone and small yields (≤0.5 L per minute).
- In wells sampled during seasonal groundwater low conditions with greatly reduced yield.

The Type II sampling technique will be used in the following situations:

- In a well with potential or documented multiple flow zones and where individual flow zones will not be evaluated.

- In moderately producing wells (>0.5 L per minute) where no discrete flow zones were documented during drilling.
- In wells sampled during seasonal high groundwater conditions with enhanced yield (and potentially additional flow zones).

Groundwater samples will be collected no sooner than 1 week (minimum) after well development or no sooner than 2 weeks in wells where airlifting was employed to remove excessive sediments. The total depth of the well and the depth of the water-producing zones will be obtained from the well-drilling logs. The sustainable pumping rate and baseline turbidity for each well will be estimated during well development. Whenever possible, the wells will not be purged to dryness.

Type I Low-Flow Sampling Procedures

Type I sampling procedures include the following activities:

- Note the existing condition of the well and wellhead.
- Monitor the headspace of the well with an organic vapor monitor (OVM) instrument as the well cap is removed.
- Measure the depth to water.
- Calculate the standing water column in the well by subtracting the depth to water from the total depth of the well as recorded during the drilling of the well.
- Slowly lower a clean, stainless-steel, adjustable flow rate submersible pump and dedicated polyethylene tubing to the desired depth to minimize sediment disturbance. For wells with very low sustainable pumping rates (≤0.5 liters per minute), the pumps will be set in the middle of the water column 12 hours prior to purging so that the depth to water equilibrates and sediments disturbed during pump placement have time to settle. For wells with sustainable pumping rates (>0.5 liters per minute), the pumps will be set at the desired flow zone depth or at the center of the water column (depending on the sampling objectives) prior to purging, allowing for the depth to water to equilibrate before purging.
- Immediately prior to purging, the depth to water will be measured and recorded. Start purging the well at the minimum achievable pumping rate. The samples will attempt to achieve a pumping rate of 100 ml per minute. If field conditions (variations in depth to water and voltage output of the generator) do not allow flow at 100 ml per minute, then the lowest reasonable pumping rate will be maintained and documented. Water-level measurements will be made continuously to document the stabilization of the water level with minimal (0.2 ft) drawdown. If the recharge rate of the well is less

than the minimum pumping rate (i.e., purging will be interrupted as needed), every attempt will be made so that drawdown does not proceed to the level below the top of the well intake.

- Measure the pH, specific conductance, Eh, and D.O. of the purge water from an in-line flow-through cell(s) every 3 to 5 minutes. There should be no air bubbles observed in the tubing.

- Continue purging until stabilization is achieved. Stabilization is defined as three consecutive readings that are within the following criteria:

  - pH: ±0.1 unit
  - Specific conductivity: ±3%
  - Eh: ±10 mV
  - D.O.: ±10%

- Continue pumping once purging is completed and reduce the rate to its lowest level and disconnect the tubing from the in-line flow-through cell(s).

- Collect groundwater samples directly from the end of the tubing into clean laboratory-prepared (preserved) labeled bottles.

- Handle and ship the samples according to the procedures outlined in Section 5.4 of this SAP.

- After sample collection is complete, remove the pump and the tubing. Note: sample tubing will be dedicated to each well.

- Measure the total depth of the well.

- Secure the well by replacing and locking the lid.

<u>Type II Conventional Sampling Procedures</u>

Type II sampling procedures include the following activities:

- Note the existing condition of the well and wellhead.

- Monitor the headspace of the well with an "OVM" instrument as the well cap is removed if previous monitoring indicates that OVM monitoring is necessary.

- Measure the depth to water.

- Calculate the standing water column in the well by subtracting the depth to water from the total depth of the well as recorded during the drilling of the well.

- Slowly lower a clean, stainless-steel, adjustable flow rate submersible pump and dedicated polyethylene tubing to the middle of the water column.

- Start purging the well at the minimum achievable pumping rate. Gradually increase the pumping rate to achieve the maximum flow rate of the pump or the maximum flow rate that does not draw down the static water level to a point below the top of the first water-bearing zone, whichever is achieved first.

- Measure the pH, specific conductance, Eh, and D.O. of the purge water.

- Note when each parameter stabilizes. Stabilization is defined as three consecutive readings that are within the following criteria:

  - pH: ±0.1 unit
  - Specific conductivity: ±3%
  - Eh: ±10 mV
  - D.O.: ±10%

- Three calculated well volumes will be removed prior to sampling. It will be documented if stabilization of the indicator parameters has not occurred after three calculated well volumes have been removed and sampling procedures begin.

- Collect groundwater samples by lowering a dedicated Teflon bailer with disposable polypropylene rope into the water. The water will be poured into clean laboratory-prepared (preserved) labeled bottles. Handle and ship the samples according to procedures outlined in Subsection 5.4 of this SAP.

Sampling Procedures for Recovery Wells

Wells with active pumps (W-1, W-10) will be sampled from the current piping system from a sampling ports located close to the well head. The pumps will be run for a minimum of 15 minutes and the sampling port opened and allowed to flow for 10 seconds prior to sampling. This will be done to purge the lines of any stagnant water to obtain a sample representative of existing groundwater conditions.

4.5 SAMPLE IDENTIFICATION PROTOCOL

A unique field sample identification code will be assigned to each sample collected. For water

samples, the identification code will consist of the following three parts separated by hyphens:

Part 1		Part 2		Part 3
XXXX	-	XXXXXX	-	XX
Location Identification	-	Collection Date Identification	-	Sample Type Identification

Location Identification

The *Location Identification Code* will not exceed four characters in length. Location identification codes will be unique identifiers consisting of character codes that describe the sample type and location. Table 4-1 lists and describes some of the location identification codes available. Please note that numbers 1-9 shall be written as two-dig numbers (i.e., 01-09).

Table 4-1

Location Identification Codes

Location ID	Description
AS01	Assessment Well AS-1
I02	Site well I-2
I04	Site well I-4
I05	Site well I-5
L01	Site well L-1
L03	Background well L-3
L05	Assessment well L-5
R01	Site well R-1
R02	Compliance Well R-2
R03	Compliance Well R-3
R04	Compliance Well R-4
R05	Compliance Well R-5
S04	Compliance Well S-4
W01	Assessment well W-1
W02	Site Well W-2
W10	Assessment well W-10

Collection Date

The *Collection Date* portion of the sample identification code will not exceed six characters in length. The six-character date code will be:

MMDDYY

-MM—signifies a two-digit numeric code representing the month the sample was collected (01=January, 02=February, 03=March, 04=April, 05=May, 06=June, 07=July, 08=August, 09=September, 10=October, 11=November, 12=December).

-DD—signifies a two-digit numeric code representing the day the sample was collected. Valid values will include numbers from 01 to 31.

-YY—signifies a two-digit numeric code representing the year the sample was collected (i.e., – 02= 2002, 03=2003, etc.).

Sample Type

The *Sample Type* will be a two-digit number representing the sample quality control (QC) type. Table 4-2 lists and describes the possible QC types.

Table 4-2

QC Codes and Descriptions

QC Code	Description
01	Normal Sample
02	Field Duplicate Sample
03	Equipment Blank Sample
04	Trip Blank Sample

5. SAMPLE MANAGEMENT

5.1 DOCUMENTATION

Field data for soil borings, well installation, and groundwater sampling will be recorded by field personnel using WESTON's Geologic Logging and Interpretation System (GEOLIS®), or some other designate logging forms. Examples of the GEOLIS® forms are provided in Appendix B. Five GEOLIS® forms which may be used by field personnel: the Borehole Location Form, the Lithologic Logging Form, the Well Construction Form, the Water Sampling Form, and the Well Purging Form. The forms are used to record the following information:

- Borehole Location Form: Provides information on borehole specifics, such as the site and location identification number, start and finish date, geologist and driller identification, and type of drill rig and drilling method used.
- Lithologic Logging Form: Provides a detailed checklist for describing the soil and bedrock encountered during drilling. The Lithologic Logging Form allows the geologist to describe the soils or bedrock using a combination of standardized parameters. Information is recorded for the following data types: standard penetration, recovery, sampling method, analytical samples collected, organic vapor readings, and lithologic data required for classification using American Society for Testing and Materials (ASTM) Method D2488.
- Well Construction Form: Provides well construction information, such as well location identification number, start and finish date, well type, a summary of the well construction materials, and a well construction diagram.
- Water Sampling Form: Provides groundwater sampling information, such as sample identification number, sample date and time, sample type, sampling method, sample parameters, and associated QC sample(s).
- Well Purging Form: Provides information about the physical condition of the well and well purging information, such as depth to water, well purging volume, purging method, and field measurement readings.

Forms will be bound in a logbook for recording data in the field. Once the soil borings are complete, the forms will be entered into an electronic database for storage and data retrieval.

Data for all other field activities will be recorded in a field logbook. In addition, field activities, as necessary, will be recorded with a video camera and/or a digital camera.

5.2 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality assurance/quality control (QA/QC) procedures to be implemented during the EKCO facility remediation program will include: one set of trip blank samples for each sample cooler containing samples; one set of equipment blank samples each day for non-dedicated sampling devices; field duplicate samples to be collected at a rate of 1 for every 10 samples to be analyzed; and MS/MSD pairs to be collected at a rate of 1 for every 20 samples.

5.3 LABORATORY METHODS

Laboratory methods are listed in Table 4-1 of the QAPP (COPR, Vol. 2) for the facility.

5.4 SAMPLE SHIPMENT

Sample Handling

Samples collected in laboratory sample jars will be handled in the following manner:

- Label the sample jars with the project name and number, unique sample I.D. number, sample date and time of collection, sample procedure (i.e., composite, grab, etc.), preservative used, analysis requested, and sampler's initials.
- Affix a signed and dated custody seal to the lid and side of the sample jar.
- Place the sample jar in a resealable plastic bag.
- Store the sample in a cooler with sufficient ice to maintain a 4 °C temperature.

Sample Chain-of-Custody

A chain-of-custody (CoC) form will be completed and will travel with the samples. The following information should be completed on the CoC form:

- Site name.
- Laboratory name and contact.
- Turnaround time—30 days (unless site-specific conditions require faster turnaround time).
- Sample I.D., matrix, sampled date, and collection time.

- Parameters, analytical methods, reporting limits (standard or lower), PID or OVM readings, bottle type, bottle volume, sample type, and preservative.
- Sign release on bottom of CoC form.

Shipping Procedures

The field personnel will notify the laboratory 24 to 48 hours in advance of sample shipment so that the laboratory personnel will be alerted for receipt of sample shipment. Field logbooks will contain the laboratory point of contact (POC), phone number, and address.

Samples will be packed and shipped following applicable U.S. Department of Transportation (DOT) regulations, WESTON corporate guidelines, and International Air Transport Association (IATA) standards (if shipped by air carrier) (as detailed in the most current edition of *IATA Dangerous Goods Regulations for Hazardous Materials Shipments*). Samples will be handled as follows:

- Place samples in a cooler and surround them with vermiculite (or equivalent) packaging material for stability during transport.
- Place sufficient double-bagged ice (or dry ice, as required) in the cooler to maintain a temperature of 4 °C ± 2 °C.
- Place in each cooler a temperature blank (D.I. water in a 2-ounce [oz.] plastic bottle) precooled to below 4 °C. The temperature inside the cooler will be recorded by the laboratory upon receipt.
- Place completed CoC form inside a resealable plastic bag, and attach the bag to the inside of the cooler lid.
- Secure the cooler lid with packing tape. Place signed and dated custody seals on two opposite sides of the lid and secure with clear tape.
- If applicable, tape the drain plug closed so that it will not open.
- Place upward-pointing arrow label on the four vertical sides of the cooler.
- Label with laboratory address, name of laboratory contact, telephone number, and project identification (as noted previously).
- Label as “Excepted Quantity” as per IATA regulations (if applicable).

Samples will be classified as environmental samples unless there is evidence of high concentrations of contaminants based on visual observations of heavy staining or saturations with a contaminant "product." In the unlikely event that hazardous materials samples are obtained during the field investigation, the packing and transportation of these samples will conform to the IATA Dangerous Goods Regulations for shipping a flammable liquid if shipped by air carrier. At least one person on the WESTON field team will have completed the IATA dangerous goods shipping class.

6. SUPPLEMENTAL ACTIVITIES

6.1 DECONTAMINATION PROCEDURES

The drilling rig and all downhole drilling tools will be decontaminated prior to the beginning and at the end of the drilling operation. The on-site geologist/soil scientist will inspect the decontaminated equipment prior to mobilizing to each new location. The surfaces of the drill rig and associated drilling tools will be decontaminated at a central decontamination area using the following procedures:

- Remove all gross amounts of mud/soil using a shovel, wire brush, or other tools at each boring location.
- Transport drill rig and tools to the decontamination area.
- If necessary, use a brush and nonphosphate detergent and potable water solution to scrub the drilling tools (if the soil/mud on the tools can be easily removed by steam cleaning, this step can be skipped).
- Elevate the drilling tools above the ground surface. Pressure-wash the drill rig and tools using an approved potable water source. Any decontaminated equipment stored on the ground surface must be placed on clean plastic.

The Geoprobe® macrosampler tool will be decontaminated between boreholes with a brush and nonphosphate detergent and water solution, followed by a potable and D.I. water rinse. These decontamination procedures will be conducted at each site using 5-gal. buckets to contain the cleaning solutions.

Split-spoon samplers, cutting heads for the Geoprobe® macrosampler, stainless-steel bowls and trowels, chisel for concrete chip samples, and scoops and scoopulas will be decontaminated after use to prevent cross-contamination between sampling points. These sampling devices will be decontaminated according to the following procedures:

- Scrub the inside and the outside of the split-spoon sampler with a brush using a nonphosphate detergent and water solution (approved potable water source).
- Rinse with potable water.

- Spray with isopropanol. Collect isopropanol rinsate in a tub or bucket and allow to evaporate.
- Allow the sampler to air dry.
- Rinse with D.I. water.
- Wrap the sampler with aluminum foil.

Water-level probes will be decontaminated with a nonphosphate detergent scrub, followed by a thorough D.I. water rinse.

The stainless-steel submersible pumps used for purging monitoring wells will be decontaminated using the following procedures:

- Place pump and wiring in bucket/container with a nonphosphate detergent and water solution (approved potable water source). Scrub the pump and wiring with a brush and pump the detergent solution through the pump.
- Rinse pump and wiring with approved potable water source. Purge water through the pump.
- Final rinse with approved potable water.

At the end of the decontamination procedures, the detergent solution will be disposed of as detailed in Subsection 7.3.

6.2 SURVEYING

All soil sampling locations and newly installed groundwater monitor wells will be surveyed upon completion of installation and sampling. The locations shall be surveyed relative to the Ohio State Plane Coordinate System and the National Geodetic Vertical Datum. The level of accuracy required will be +/- 1 foot for horizontal plane surveying and +/- 0.01 foot for all vertical surveying.

7. REFERENCES

U.S. EPA. 2002. "Administrative Order on Consent, Scope of Work, World Kitchen, Inc. Massillon, Ohio Facility." Region 5 Waste Pesticides, and Toxics Division, Chicago, IL.

U.S. EPA. 1998. *Resource Conservation and Recovery Act (RCRA) Quality Assurance Project Plan (QAPP) Instructions.* Region 5 Waste, Pesticides, and Toxics Division. Chicago, IL.

WESTON. 2001. "Final Soil Investigation Report for the EKCO WKI Facility, Massillon, Ohio."

WESTON. 1993. "Final Corrective Measures Study, EKCO Housewares, Inc., Massillon, Ohio."

APPENDIX A
EPA METHOD 5035

METHOD 5035

CLOSED-SYSTEM PURGE-AND-TRAP AND EXTRACTION FOR VOLATILE ORGANICS IN SOIL AND WASTE SAMPLES

1.0 SCOPE AND APPLICATION

1.1 This method describes a closed-system purge-and-trap process for the analysis of volatile organic compounds (VOCs) in solid materials (e.g., soils, sediments, and solid waste). While the method is designed for use on samples containing low levels of VOCs, procedures are also provided for collecting and preparing solid samples containing high concentrations of VOCs and for oily wastes. For these high concentration and oily materials, sample collection and preparation are performed using the procedures described here, and sample introduction is performed using the aqueous purge-and-trap procedure in Method 5030. These procedures may be used in conjunction with any appropriate determinative gas chromatographic procedure, including, but not limited to, Methods 8015, 8021, and 8260.

1.2 The low soil method utilizes a hermetically-sealed sample vial, the seal of which is never broken from the time of sampling to the time of analysis. Since the sample is never exposed to the atmosphere after sampling, the losses of VOCs during sample transport, handling, and analysis are negligible. The applicable concentration range of the low soil method is dependent on the determinative method, matrix, and compound. However, it will generally fall in the 0.5 to 200 µg/kg range.

1.3 Procedures are included for preparing high concentration samples for purging by Method 5030. High concentration samples are those containing VOC levels of >200 µg/kg.

1.4 Procedures are also included for addressing oily wastes that are soluble in a water-miscible solvent. These samples are also purged using Method 5030..

1.5 Method 5035 can be used for most volatile organic compounds that have boiling points below 200°C and that are insoluble or slightly soluble in water. Volatile, water-soluble compounds can be included in this analytical technique. However, quantitation limits (by GC or GC/MS) are approximately ten times higher because of poor purging efficiency.

1.6 Method 5035, in conjunction with Method 8015 (GC/FID), may be used for the analysis of the aliphatic hydrocarbon fraction in the light ends of total petroleum hydrocarbons, e.g., gasoline. For the aromatic fraction (BTEX), use Method 5035 and Method 8021 (GC/PID). A total determinative analysis of gasoline fractions may be obtained using Method 8021 in series with Method 8015.

1.7 As with any preparative method for volatiles, samples should be screened to avoid contamination of the purge-and-trap system by samples that contain very high concentrations of purgeable material above the calibration range of the low concentration method. In addition, because the sealed sample container cannot be opened to remove a sample aliquot without compromising the integrity of the sample, multiple sample aliquots should be collected to allow for screening and reanalysis.

1.8 The closed-system purge-and-trap equipment employed for low concentration samples is not appropriate for soil samples preserved in the field with methanol. Such samples should be analyzed using Method 5030 (see the note in Sec. 6.2.2).

1.9 This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method.

2.0 SUMMARY OF METHOD

2.1 Low concentration soil method - generally applicable to and soils and other solid samples with VOC concentrations in the range of 0.5 to 200 µg/kg.

Volatile organic compounds (VOCs) are determined by collecting an approximately 5-g sample, weighed in the field at the time of collection, and placing it in a pre-weighed vial with a septum-sealed screw-cap (see Sec. 4) that already contains a stirring bar and a sodium bisulfate preservative solution. The vial is sealed and shipped to a laboratory or appropriate analysis site. The entire vial is then placed, unopened, into the instrument carousel. Immediately before analysis, organic-free reagent water, surrogates, and internal standards (if applicable) are automatically added without opening the sample vial. The vial containing the sample is heated to 40°C and the volatiles purged into an appropriate trap using an inert gas combined with agitation of the sample. Purged components travel via a transfer line to a trap. When purging is complete, the trap is heated and backflushed with helium to desorb the trapped sample components into a gas chromatograph for analysis by an appropriate determinative method.

2.2 High concentration soil method - generally applicable to soils and other solid samples with VOC concentrations greater than 200 µg/kg.

The sample introduction technique in Sec. 2.1 is not applicable to all samples, particularly those containing high concentrations (generally greater than 200 µg/kg) of VOCs which may overload either the volatile trapping material or exceed the working range of the determinative instrument system (e.g., GC/MS, GC/FID, GC/EC, etc.). In such instances, this method describes two sample collection options and the corresponding sample purging procedures.

2.2.1 The first option is to collect a bulk sample in a vial or other suitable container without the use of the preservative solution described in Sec. 2.1. A portion of that sample is removed from the container in the laboratory and is dispersed in a water-miscible solvent to dissolve the volatile organic constituents. An aliquot of the solution is added to 5 mL of reagent water in a purge tube. Surrogates and internal standards (if applicable) are added to the solution, then purged using Method 5030, and analyzed by an appropriate determinative method. Because the procedure involves opening the vial and removing a portion of the soil, some volatile constituents may be lost during handling.

2.2.2 The second option is to collect an approximately 5-g sample in a pre-weighed vial with a septum-sealed screw-cap (see Sec 4) that contains 5 mL of a water-miscible organic solvent (e.g., methanol). At the time of analysis, surrogates are added to the vial, then an aliquot of the solvent is removed from the vial, purged using Method 5030 and analyzed by an appropriate determinative method.

2.3 High concentration oily waste method - generally applicable to oily samples with VOC concentrations greater than 200 µg/kg that can be diluted in a water-miscible solvent.

Samples that are comprised of oils or samples that contain significant amounts of oil present additional analytical challenges. This procedure is generally appropriate for such samples when they are soluble in a water-miscible solvent.

2.3.1 After demonstrating that a test aliquot of the sample is soluble in methanol or polyethylene glycol (PEG), a separate aliquot of the sample is spiked with surrogates and diluted in the appropriate solvent. An aliquot of the solution is added to 5 mL of reagent water in a purge tube, taking care to ensure that a floating layer of oil is not present in the purge tube. Internal standards (if applicable) are added to the solution which is then purged using Method 5030 and analyzed by an appropriate determinative method.

2.3.2 Samples that contain oily materials that are not soluble in water-miscible solvents must be prepared according to Method 3585.

3.0 INTERFERENCES

3.1 Impurities in the purge gas and from organic compounds out-gassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running method blanks. The use of non-polytetrafluoroethylene (non-PTFE) plastic coating, non-PTFE thread sealants, or flow controllers with rubber components in the purging device must be avoided, since such materials out-gas organic compounds which will be concentrated in the trap during the purge operation. These compounds will result in interferences or false positives in the determinative step.

3.2 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal of the sample vial during shipment and storage. A trip blank prepared from organic-free reagent water and carried through sampling and handling protocols serves as a check on such contamination.

3.3 Contamination by carryover can occur whenever high-concentration and low-concentration samples are analyzed in sequence. Where practical, samples with unusually high concentrations of analytes should be followed by an analysis of organic-free reagent water to check for cross-contamination. If the target compounds present in an unusually concentrated sample are also found to be present in the subsequent samples, the analyst must demonstrate that the compounds are not due to carryover. Conversely, if those target compounds are <u>not</u> present in the subsequent sample, then the analysis of organic-free reagent water is not necessary.

3.4 The laboratory where volatile analysis is performed should be completely free of solvents. Special precautions must be taken to determine methylene chloride. The analytical and sample storage area should be isolated from all atmospheric sources of methylene chloride, otherwise random background levels will result. Since methylene chloride will permeate through PTFE tubing, all GC carrier gas lines and purge gas plumbing should be constructed of stainless steel or copper tubing. Laboratory workers' clothing previously exposed to methylene chloride fumes during common liquid/liquid extraction procedures can contribute to sample contamination. The presence of other organic solvents in the laboratory where volatile organics are analyzed will also lead to random background levels and the same precautions must be taken.

4.0 APPARATUS AND MATERIALS

4.1 Sample Containers

The specific sample containers required will depend on the purge-and-trap system to be employed (see Sec. 4.2). Several systems are commercially available. Some systems employ 40-mL clear vials with a special frit and equipped with two PTFE-faced silicone septa. Other

systems permit the use of any good quality glass vial that is large enough to contain at least 5 g of soil or solid material and at least 10 mL of water and that can be sealed with a screw-cap containing a PTFE-faced silicone septum. Consult the purge-and-trap system manufacturer's instructions regarding the suitable specific vials, septa, caps, and mechanical agitation devices.

4.2 Purge-and-Trap System

The purge-and-trap system consists of a unit that automatically adds water, surrogates, and internal standards (if applicable) to a vial containing the sample, purges the VOCs using an inert gas stream while agitating the contents of the vial, and also traps the released VOCs for subsequent desorption into the gas chromatograph. Such systems are commercially available from several sources and shall meet the following specifications.

4.2.1 The purging device should be capable of accepting a vial sufficiently large to contain a 5-g soil sample plus a magnetic stirring bar and 10 mL of water. The device must be capable of heating a soil vial to 40°C and holding it at that temperature while the inert purge gas is allowed to pass through the sample. The device should also be capable of introducing at least 5 mL of organic-free reagent water into the sample vial while trapping the displaced headspace vapors. It must also be capable of agitating the sealed sample during purging, (e.g., using a magnetic stirring bar added to the vial prior to sample collection, sonication, or other means). The analytes being purged must be quantitatively transferred to an absorber trap. The trap must be capable of transferring the absorbed VOCs to the gas chromatograph (see 4.2.2).

NOTE: The equipment used to develop this method was a Dynatech PTA-30 W/S Autosampler. This device was subsequently sold to Varian, and is now available as the Archon Purge and Trap Autosampler. See the Disclaimer at the front of this manual for guidance on the use of alternative equipment.

4.2.2 A variety of traps and trapping materials may be employed with this method. The choice of trapping material may depend on the analytes of interest. Whichever trap is employed, it must demonstrate sufficient adsorption and desorption characteristics to meet the quantitation limits of all the target analytes for a given project and the QC requirements in Method 8000 and the determinative method. The most difficult analytes are generally the gases, especially dichlorodifluoromethane. The trap must be capable of desorbing the late eluting target analytes.

NOTE: Check the responses of the brominated compounds when using alternative charcoal traps (especially Vocarb 4000), as some degradation has been noted when higher desorption temperatures (especially above 240 - 250°C) are employed. 2-Chloroethyl vinyl ether is degraded on Vocarb 4000 but performs adequately when Vocarb 3000 is used. The primary criterion, as stated above, is that all target analytes meet the sensitivity requirements for a given project.

4.2.2.1 The trap used to develop this method was 25 cm long, with an inside diameter of 0.105 inches, and was packed with Carbopack/Carbosieve (Supelco, Inc.).

4.2.2.2 The standard trap used in other EPA purge-and-trap methods is also acceptable. That trap is 25 cm long and has an inside diameter of at least 0.105 in. Starting from the inlet, the trap contains the equal amounts of the adsorbents listed below. It is recommended that 1.0 cm of methyl silicone-coated packing (35/60 mesh, Davison, grade 15 or equivalent) be inserted at the inlet to extend the life of the trap. If

the analysis of dichlorodifluoromethane or other fluorocarbons of similar volatility is not required, then the charcoal can be eliminated and the polymer increased to fill 2/3 of the trap. If only compounds boiling above 35°C are to be analyzed, both the silica gel and charcoal can be eliminated and the polymer increased to fill the entire trap.

4.2.2.2.1 2,6-Diphenylene oxide polymer - 60/80 mesh, chromatographic grade (Tenax GC or equivalent).

4.2.2.2.2 Methyl silicone packing - OV-1 (3%) on Chromosorb-W, 60/80 mesh or equivalent.

4.2.2.2.3 Coconut charcoal - Prepare from Barnebey Cheney, CA-580-26, or equivalent, by crushing through 26 mesh screen.

4.2.2.3 Trapping materials other than those listed above also may be employed, provided that they meet the specifications in Sec. 4.2.3, below.

4.2.3 The desorber for the trap must be capable of rapidly heating the trap to the temperature recommended by the trap material manufacturer, prior to the beginning of the flow of desorption gas. Several commercial desorbers (purge-and-trap units) are available.

4.3 Syringe and Syringe Valves

4.3.1 25-mL glass hypodermic syringes with Luer-Lok (or equivalent) tip (other sizes are acceptable depending on sample volume used).

4.3.2 2-way syringe valves with Luer ends.

4.3.3 25-µL micro syringe with a 2 inch x 0.006 inch ID, 22° bevel needle (Hamilton #702N or equivalent).

4.3.4 Micro syringes - 10-, 100-µL.

4.3.5 Syringes - 0.5-, 1.0-, and 5-mL, gas-tight with shut-off valve.

4.4 Miscellaneous

4.4.1 Glass vials

4.4.1.1 60-mL, septum-sealed, to collect samples for screening, dry weight determination.

4.4.1.2 40-mL, screw-cap, PTFE lined, septum-sealed. Examine each vial prior to use to ensure that the vial has a flat, uniform sealing surface.

4.4.2 Top-loading balance - Capable of accurately weighing to 0.01 g.

4.4.3 Glass scintillation vials - 20-mL, with screw-caps and PTFE liners, or glass culture tubes with screw-caps and PTFE liners, for dilution of oily waste samples.

4.4.4 Volumetric flasks - Class A, 10-mL and 100-mL, with ground-glass stoppers.

4.4.5 2-mL glass vials, for GC autosampler - Used for oily waste samples extracted with methanol or PEG.

4.4.6 Spatula, stainless steel - narrow enough to fit into a sample vial.

4.4.7 Disposable Pasteur pipettes.

4.4.8 Magnetic stirring bars - PTFE- or glass-coated, of the appropriate size to fit the sample vials. Consult manufacturer's recommendation for specific stirring bars. Stirring bars may be reused, provided that they are thoroughly cleaned between uses. Consult the manufacturers of the purging device and the stirring bars for suggested cleaning procedures.

4.5 Field Sampling Equipment

4.5.1 Purge-and-Trap Soil Sampler - Model 3780PT (Associated Design and Manufacturing Company, 814 North Henry Street, Alexandria, VA 22314), or equivalent.

4.5.2 EnCore™ sampler - (En Chem, Inc., 1795 Industrial Drive, Green Bay, WI 54302), or equivalent.

4.5.3 Alternatively, disposable plastic syringes with a barrel smaller than the neck of the soil vial may be used to collect the sample. The syringe end of the barrel is cut off prior to sampling. One syringe is needed for each sample aliquot to be collected.

4.5.4 Portable balance - For field use, capable of weighing to 0.01 g.

4.5.5 Balance weights - Balances employed in the field should be checked against an appropriate reference weight at least once daily, prior to weighing any samples, or as described in the sampling plan. The specific weights used will depend on the total weight of the sample container, sample, stirring bar, reagent water added, cap, and septum.

5.0 REAGENTS

5.1 Organic-free reagent water - All references to water in this method refer to organic-free reagent water, as defined in Chapter One.

5.2 Methanol, CH_3OH - purge-and-trap quality or equivalent. Store away from other solvents.

5.3 Polyethylene glycol (PEG), $H(OCH_2CH_2)_nOH$ - free of interferences at the detection limit of the target analytes.

5.4 Low concentration sample preservative

5.4.1 Sodium bisulfate, $NaHSO_4$ - ACS reagent grade or equivalent.

5.4.2 The preservative should be added to the vial prior to shipment to the field, and must be present in the vial prior to adding the sample.

5.5 See the determinative method and Method 5000 for guidance on internal standards and surrogates to be employed in this procedure.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

Refer to the introductory material in this chapter, Organic Analytes, Sec. 4.1, for general sample collection information. The low concentration portion of this method employs sample vials that are filled and weighed in the field and never opened during the analytical process. As a result, sampling personnel should be equipped with a portable balance capable of weighing to 0.01 g.

6.1 Preparation of sample vials

The specific preparation procedures for sample vials depend on the expected concentration range of the sample, with separate preparation procedures for low concentration soil samples and high concentration soil and solid waste samples. Sample vials should be prepared in a fixed laboratory or other controlled environment, sealed, and shipped to the field location. Gloves should be worn during the preparation steps.

6.1.1 Low concentration soil samples

The following steps apply to the preparation of vials used in the collection of low concentration soil samples to be analyzed by the closed-system purge-and-trap equipment described in Method 5035.

6.1.1.1 Add a clean magnetic stirring bar to each clean vial. If the purge-and-trap device (Sec. 4.2) employs a means of stirring the sample other than a magnetic stirrer (e.g., sonication or other mechanical means), then the stir bar is omitted.

6.1.1.2 Add preservative to each vial. The preservative is added to each vial prior to shipping the vial to the field. Add approximately 1 g of sodium bisulfate to each vial. If samples markedly smaller or larger than 5 g are to be collected, adjust the amount of preservative added to correspond to approximately 0.2 g of preservative for each 1 g of sample. Enough sodium bisulfate should be present to ensure a sample pH of $\leq$2.

6.1.1.3 Add 5 mL of organic-free reagent water to each vial. The water and the preservative will form an acid solution that will reduce or eliminate the majority of the biological activity in the sample, thereby preventing biodegradation of the volatile target analytes.

6.1.1.4 Seal the vial with the screw-cap and septum seal. If the double-ended, fritted, vials are used, seal both ends as recommended by the manufacturer.

6.1.1.5 Affix a label to each vial. This eliminates the need to label the vials in the field and assures that the tare weight of the vial includes the label. (The weight of any markings added to the label in the field is negligible).

6.1.1.6 Weigh the prepared vial to the nearest 0.01 g, record the tare weight, and write it on the label.

6.1.1.7 Because volatile organics will partition into the headspace of the vial from the aqueous solution and will be lost when the vial is opened, surrogates, matrix spikes, and internal standards (if applicable) should only be added to the vials after the sample has been added to the vial. These standards should be introduced back in the

laboratory, either manually by puncturing the septum with a small-gauge needle or automatically by the sample introduction system, just prior to analysis.

6.1.2 High concentration soil samples collected without a preservative

When high concentration samples are collected without a preservative, a variety of sample containers may be employed, including 60-mL glass vials with septum seals (see Sec. 4.4).

6.1.3 High concentration soil samples collected and preserved in the field

The following steps apply to the preparation of vials used in the collection of high concentration soil samples to be preserved in the field with methanol and analyzed by the aqueous purge-and-trap equipment described in Method 5030.

6.1.3.1 Add 10 mL of methanol to each vial.

6.1.3.2 Seal the vial with the screw-cap and septum seal.

6.1.3.3 Affix a label to each vial. This eliminates the need to label the vials in the field and assures that the tare weight of the vial includes the label. (The weight of any markings added to the label in the field is negligible).

6.1.3.4 Weigh the prepared vial to the nearest 0.01 g, record the tare weight, and write it on the label.

NOTE: Vials containing methanol should be weighed a second time on the day that they are to be used. Vials found to have lost methanol (reduction in weight of >0.01 g) should not be used for sample collection.

6.1.3.5 Surrogates, internal standards and matrix spikes (if applicable) should be added to the sample after it is returned to the laboratory and prior to analysis.

6.1.4 Oily waste samples

When oily waste samples are known to be soluble in methanol or PEG, sample vials may be prepared as described in Sec. 6.1.3, using the appropriate solvent. However, when the solubility of the waste is unknown, the sample should be collected without the use of a preservative, in a vial such as that described in Sec. 6.1.2.

6.2 Sample collection

Collect the sample according to the procedures outlined in the sampling plan. As with any sampling procedure for volatiles, care must be taken to minimize the disturbance of the sample in order to minimize the loss of the volatile components. Several techniques may be used to transfer a sample to the relatively narrow opening of the low concentration soil vial. These include devices such as the EnCore™ sampler, the Purge-and-Trap Soil Sampler ™, and a cut plastic syringe. Always wear gloves whenever handling the tared sample vials.

6.2.1 Low concentration soil samples

6.2.1.1 Using an appropriate sample collection device, collect approximately 5 g of sample as soon as possible after the surface of the soil or other solid material has been exposed to the atmosphere: generally within a few minutes at most. Carefully wipe the exterior of the sample collection device with a clean cloth or towel.

6.2.1.2 Using the sample collection device, add about 5 g (2 - 3 cm) of soil to the sample vial containing the preservative solution. Quickly brush any soil off the vial threads and immediately seal the vial with the septum and screw-cap. Store samples on ice at 4°C.

NOTE: Soil samples that contain carbonate minerals (either from natural sources or applied as an amendment) may effervesce upon contact with the acidic preservative solution in the low concentration sample vial. If the amount of gas generated is very small (i.e., several mL), any loss of volatiles as a result of such effervescence may be minimal if the vial is sealed quickly. However, if larger amounts of gas are generated, not only may the sample lose a significant amount of analyte, but the gas pressure may shatter the vial if the sample vial is sealed. Therefore, when samples are known or suspected to contain high levels of carbonates, a test sample should be collected, added to a vial, and checked for effervescence. If a rapid or vigorous reaction occurs, discard the sample and collect low concentration samples in vials that do not contain the preservative solution.

6.2.1.3 When practical, use a portable balance to weigh the sealed vial containing the sample to ensure that 5.0 ± 0.5 g of sample were added. The balance should be calibrated in the field using an appropriate weight for the sample containers employed (Sec. 4.5.5). Record the weight of the sealed vial containing the sample to the nearest 0.01 g.

6.2.1.4 Alternatively, collect several trial samples with plastic syringes. Weigh each trial sample and note the length of the soil column in the syringe. Use these data to determine the length of soil in the syringe that corresponds to 5.0 ± 0.5 g. Discard each trial sample.

6.2.1.5 As with the collection of aqueous samples for volatiles, collect at least two replicate samples. This will allow the laboratory an additional sample for reanalysis. The second sample should be taken from the same soil stratum or the same section of the solid waste being sampled, and within close proximity to the location from which the original sample was collected.

6.2.1.6 In addition, since the soil vial cannot be opened without compromising the integrity of the sample, at least one additional aliquot of sample must be collected for screening, dry weight determination, and high concentration analysis (if necessary). This third aliquot may be collected in a 60-mL glass vial or a third 40-mL soil sample vial. However, this third vial must *not* contain the sample preservative solution, as an aliquot will be used to determine dry weight. If high concentration samples are collected in vials containing methanol, then two additional aliquots should be collected, one for high concentration analysis collected in a vial containing methanol, and another for the dry weight determination in a vial without either methanol or the low concentration aqueous preservative solution.

6.2.1.7 If samples are known or expected to contain target analytes over a wide range of concentrations, thereby requiring the analyses of multiple sample aliquots, it may be advisable and practical to take an additional sample aliquot in a low concentration soil vial containing the preservative, but collecting only 1-2 g instead of the 5 g collected in Sec. 6.2.1.1. This aliquot may be used for those analytes that exceed the instrument calibration range in the 5-g analysis.

6.2.1.8 The EnCore™ sampler has not been thoroughly evaluated by EPA as a sample storage device. While preliminary results indicate that storage in the EnCore™ device may be appropriate for up to 48 hours, samples collected in this device should be transferred to the soil sample vials as soon as possible, or analyzed within 48 hours.

6.2.1.9 The collection of low concentration soil samples in vials that contain methanol is not appropriate for samples analyzed with the closed-system purge-and-trap equipment described in this method (see Sec. 6.2.2).

6.2.2 High concentration soil samples preserved in the field

The collection of soil samples in vials that contain methanol has been suggested by some as a combined preservation and extraction procedure. However, this procedure is not appropriate for use with the low concentration soil procedure described in this method.

NOTE: The use of methanol preservation has not been formally evaluated by EPA and analysts must be aware of two potential problems. First, the use of methanol as a preservative and extraction solvent introduces a significant dilution factor that will raise the method quantitation limit beyond the operating range of the low concentration direct purge-and-trap procedure (0.5-200 µg/kg). The exact dilution factor will depend on the masses of solvent and sample, but generally exceeds 1000, and may make it difficult to demonstrate compliance with regulatory limits or action levels for some analytes. Because the analytes of interest are volatile, the methanol extract cannot be concentrated to overcome the dilution problem. Thus, for samples of unknown composition, it may still be necessary to collect an aliquot for analysis by this closed-system procedure and another aliquot preserved in methanol and analyzed by other procedures. The second problem is that the addition of methanol to the sample is likely to cause the sample to fail the ignitability characteristic, thereby making the unused sample volume a hazardous waste.

6.2.2.1 When samples are known to contain volatiles at concentrations high enough that the dilution factor will not preclude obtaining results within the calibration range of the appropriate determinative method, a sample may be collected and immediately placed in a sample vial containing purge-and-trap grade methanol.

6.2.2.2 Using an appropriate sample collection device, collect approximately 5 g of sample as soon as possible after the surface of the soil or other solid material has been exposed to the atmosphere: generally within a few minutes at most. Carefully wipe the exterior of the sample collection device with a clean cloth or towel.

6.2.2.3 Using the sample collection device, add about 5 g (2 - 3 cm) of soil to the vial containing 10 mL of methanol. Quickly brush any soil off the vial threads and immediately seal the vial with the septum and screw-cap. Store samples on ice at 4°C.

6.2.2.4 When practical, use a portable balance to weigh the sealed vial containing the sample to ensure that 5.0 ± 0.5 g of sample were added. The balance should be calibrated in the field using an appropriate weight for the sample containers employed (Sec. 4.5.5). Record the weight of the sealed vial containing the sample to the nearest 0.01 g.

6.2.2.5 Alternatively, collect several trial samples with plastic syringes. Weigh each trial sample and note the length of the soil column in the syringe. Use these data to determine the length of soil in the syringe that corresponds to 5.0 ± 0.5 g. Discard each trial sample.

6.2.2.6 Other sample weights and volumes of methanol may be employed, provided that the analyst can demonstrate that the sensitivity of the overall analytical procedure is appropriate for the intended application.

6.2.2.7 The collection of at least one additional sample aliquot is required for the determination of the dry weight, as described in Sec. 6.2.1.6. Samples collected in methanol should be shipped as described in Sec. 6.3, and must be clearly labeled as containing methanol, so that the samples are not analyzed using the closed-system purge-and-trap equipment described in this procedure.

6.2.3 High concentration soil sample <u>not</u> preserved in the field

The collection of high concentration soil samples that are not preserved in the field generally follows similar procedures as for the other types of samples described in Secs. 6.2.1 and 6.2.2, with the obvious exception that the sample vials contain neither the aqueous preservative solution nor methanol. However, when field preservation is not employed, it is better to collect a larger volume sample, filling the sample container as full as practical in order to minimize the headspace. Such collection procedures generally do not require the collection of a separate aliquot for dry weight determination, but it may be advisable to collect a second sample aliquot for screening purposes, in order to minimize the loss of volatiles in either aliquot.

6.2.4 Oily waste samples

The collection procedures for oily samples depend on knowledge of the waste and its solubility in methanol or other solvents.

6.2.4.1 When an oily waste is <u>known</u> to be soluble in methanol or PEG, the sample may be collected in a vial containing such a solvent (see Sec. 6.1.4), using procedures similar to those described in Sec. 6.2.2.

6.2.4.2 When the solubility of the oily waste is <u>not</u> known, the sample should either be collected in a vial without a preservative, as described in Sec. 6.2.3, or the solubility of a trial sample should be tested in the field, using a vial containing solvent. If the trial sample is soluble in the solvent, then collect the oily waste sample as described in Sec. 6.2.2. Otherwise, collect an unpreserved sample as described in Sec. 6.2.3.

6.3 Sample handling and shipment

All samples for volatiles analysis should be cooled to approximately 4°C, packed in appropriate containers, and shipped to the laboratory on ice, as described in the sampling plan.

6.4 Sample storage

6.4.1 Once in the laboratory, store samples at 4°C until analysis. The sample storage area should be free of organic solvent vapors.

6.4.2 All samples should be analyzed as soon as practical, and within the designated holding time from collection. Samples not analyzed within the designated holding time must be noted and the data are considered minimum values.

6.4.3 When the low concentration samples are strongly alkaline or highly calcareous in nature, the sodium bisulfate preservative solution may not be strong enough to reduce the pH of the soil/water solution to below 2. Therefore, when low concentration soils to be sampled are known or suspected to be strongly alkaline or highly calcareous, additional steps may be required to preserve the samples. Such steps include: addition of larger amounts of the sodium bisulfate preservative to non-calcareous samples, storage of low concentration samples at -10°C (taking care not to fill the vials so full that the expansion of the water in the vial breaks the vial), or significantly reducing the maximum holding time for low concentration soil samples. Whichever steps are employed, they should be clearly described in the sampling and QA project plans and distributed to both the field and laboratory personnel. See Sec. 6.2.1.2 for additional information.

7.0 PROCEDURE

This section describes procedures for sample screening, the low concentration soil method, the high concentration soil method, and the procedure for oily waste samples. High concentration samples are to be introduced into the GC system using Method 5030. Oily waste samples are to be introduced into the GC system using Method 5030 if they are soluble in a water-miscible solvent, or using Method 3585 if they are not.

7.1 Sample screening

7.1.1 It is highly recommended that all samples be screened prior to the purge-and-trap GC or GC/MS analysis. Samples may contain higher than expected quantities of purgeable organics that will contaminate the purge-and-trap system**,** thereby requiring extensive cleanup and instrument maintenance. The screening data are used to determine which is the appropriate sample preparation procedure for the particular sample, the low concentration closed-system direct purge-and-trap method (Sec. 7.2), the high concentration (methanol extraction) method (Sec. 7.3), or the nonaqueous liquid (oily waste) methanol or PEG dilution procedure (Sec. 7.4).

7.1.2 The analyst may employ any appropriate screening technique. Two suggested screening techniques employing SW-846 methods are:

7.1.2.1 Automated headspace (Method 5021) using a gas chromatograph (GC) equipped with a photoionization detector (PID) and an electrolytic conductivity detector (HECD) in series, or,

7.1.2.2 Extraction of the sample with hexadecane (Method 3820) and analysis of the extract on a GC equipped with a FID and/or an ECD.

7.1.3 The analyst may inject a calibration standard containing the analytes of interest at a concentration equivalent to the upper limit of the calibration range of the low concentration soil method. The results from this standard may be used to determine when the screening results approach the upper limit of the low concentration soil method. There are no linearity or other performance criteria associated with the injection of such a standard, and other approaches may be employed to estimate sample concentrations.

7.1.4 Use the low concentration closed-system purge-and-trap method (Sec. 7.2) if the estimated concentration from the screening procedure falls within the calibration range of the selected determinative method. If the concentration exceeds the calibration range of the low concentration soil method, then use either the high concentration soil method (Sec. 7.3), or the oily waste method (Sec. 7.4).

7.2 Low concentration soil method (Approximate concentration range of 0.5 to 200 µg/kg - the concentration range is dependent upon the determinative method and the sensitivity of each analyte.)

7.2.1 Initial calibration

Prior to using this introduction technique for any GC or GC/MS method, the system must be calibrated. General calibration procedures are discussed in Method 8000, while the determinative methods and Method 5000 provide specific information on calibration and preparation of standards. Normally, external standard calibration is preferred for the GC methods (non-MS detection) because of possible interference problems with internal standards. If interferences are not a problem, or when a GC/MS method is used, internal standard calibration may be employed.

7.2.1.1 Assemble a purge-and-trap device that meets the specification in Sec. 4.2 and that is connected to a gas chromatograph or a gas chromatograph/mass spectrometer system.

7.2.1.2 Before initial use, a Carbopack/Carbosieve trap should be conditioned overnight at 245°C by backflushing with an inert gas flow of at least 20 mL/minute. If other trapping materials are substituted for the Carbopack/Carbosieve, follow the manufacturers recommendations for conditioning. Vent the trap effluent to the hood, not to the analytical column. Prior to daily use, the trap should be conditioned for 10 minutes at 245°C with backflushing. The trap may be vented to the analytical column during daily conditioning; however, the column must be run through the temperature program prior to analysis of samples.

7.2.1.3 If the standard trap in Sec. 4.2.2.2 is employed, prior to initial use, the trap should be conditioned overnight at 180°C by backflushing with an inert gas flow of at least 20 mL/min, or according to the manufacturer's recommendations. Vent the trap effluent to the hood, not to the analytical column. Prior to daily use, the trap should be conditioned for 10 min at 180°C with backflushing. The trap may be vented to the analytical column during daily conditioning; however, the column must be run through the temperature program prior to analysis of samples.

7.2.1.4 Establish the purge-and-trap instrument operating conditions. Adjust the instrument to inject 5 mL of water, to heat the sample to 40°C, and to hold the sample at 40°C for 1.5 minutes before commencing the purge process, or as recommended by the instrument manufacturer.

7.2.1.5 Prepare a minimum of five initial calibration standards containing all the analytes of interest and surrogates, as described in Method 8000, and following the instrument manufacturer's instructions. The calibration standards are prepared in organic-free reagent water. The volume of organic-free reagent water used for calibration must be the same volume used for sample analysis (normally 5 mL added to the vial before shipping it to the field plus the organic-free reagent water added by the instrument). The calibration standards should also contain approximately the same amount of the sodium bisulfate preservative as the sample (e.g., ~1 g), as the presence of the preservative will affect the purging efficiencies of the analytes. The internal standard solution must be added automatically, by the instrument, in the same fashion as used for the samples. Place the soil vial containing the solution in the instrument carousel. In order to calibrate the surrogates using standards at five concentrations, it may be necessary to disable the automatic addition of surrogates to each vial containing a calibration standard (consult the manufacturer's instructions). Prior to purging, heat the sample vial to 40°C for 1.5 minutes, or as recommended by the manufacturer.

7.2.1.6 Carry out the purge-and-trap procedure as outlined in Secs. 7.2.3. to 7.2.5.

7.2.1.7 Calculate calibration factors (CF) or response factors (RF) for each analyte of interest using the procedures described in Method 8000. Calculate the average CF (external standards) or RF (internal standards) for each compound, as described in Method 8000. Evaluate the linearity of the calibration data, or choose another calibration model, as described in Method 8000 and the specific determinative method.

7.2.1.8 For GC/MS analysis, a system performance check must be made before this calibration curve is used (see Method 8260). If the purge-and-trap procedure is used with Method 8021, evaluate the response for the following four compounds: chloromethane; 1,1-dichloroethane; bromoform; and 1,1,2,2-tetrachloroethane. They are used to check for proper purge flow and to check for degradation caused by contaminated lines or active sites in the system.

7.2.1.8.1 Chloromethane is the most likely compound to be lost if the purge flow is too fast.

7.2.1.8.2 Bromoform is one of the compounds most likely to be purged very poorly if the purge flow is too slow. Cold spots and/or active sites in the transfer lines may adversely affect response.

7.2.1.8.3 Tetrachloroethane and 1,1-dichloroethane are degraded by contaminated transfer lines in purge-and-trap systems and/or active sites in trapping materials.

7.2.1.9 When analyzing for very late eluting compounds with Method 8021 (i.e., hexachlorobutadiene, 1,2,3-trichlorobenzene, etc.), cross-contamination and memory effects from a high concentration sample or even the standard are a common problem.

Extra rinsing of the purge chamber after analysis normally corrects this. The newer purge-and-trap systems often overcome this problem with better bakeout of the system following the purge-and-trap process. Also, the charcoal traps retain less moisture and decrease the problem.

7.2.2 Calibration verification

Refer to Method 8000 for details on calibration verification. A single standard near the mid-point of calibration range is used for verification. This standard should also contain approximately 1 g of sodium bisulfate.

7.2.3 Sample purge-and-trap

This method is designed for a 5-g sample size, but smaller sample sizes may be used. Consult the instrument manufacturer's instructions regarding larger sample sizes, in order to avoid clogging of the purging apparatus. The soil vial is hermetically sealed at the sampling site, and MUST remain so in order to guarantee the integrity of the sample. Gloves must be worn when handling the sample vial since the vial has been tared. If any soil is noted on the exterior of the vial or cap, it must be carefully removed prior to weighing. Weigh the vial and contents to the nearest 0.01 g, even if the sample weight was determined in the field, and record this weight. This second weighing provides a check on the field sampling procedures and provides additional assurance that the reported sample weight is accurate. Data users should be advised on significant discrepancies between the field and laboratory weights.

7.2.3.1 Remove the sample vial from storage and allow it to warm to room temperature. Shake the vial gently, to ensure that the contents move freely and that stirring will be effective. Place the sample vial in the instrument carousel according to the manufacturer's instructions.

7.2.3.2 Without disturbing the hermetic seal on the sample vial, add 5 mL of organic-free reagent water, the internal standards, and the surrogate compounds. This is carried out using the automated sampler. Other volumes of organic-free reagent water may be used, however, it is imperative that all samples, blanks, and calibration standards have exactly the same final volume of organic-free reagent water. Prior to purging, heat the sample vial to 40°C for 1.5 minutes, or as described by the manufacturer.

7.2.3.3 For the sample selected for matrix spiking, add the matrix spiking solution described in Sec. 5.0 of Method 5000, either manually, or automatically, following the manufacturer's instructions. The concentration of the spiking solution and the amount added should be established as described in Sec. 8.0 of Method 8000.

7.2.3.4 Purge the sample with helium or another inert gas at a flow rate of up to 40 mL/minute (the flow rate may vary from 20 to 40 mL/min, depending on the target analyte group) for 11 minutes while the sample is being agitated with the magnetic stirring bar or other mechanical means. The purged analytes are allowed to flow out of the vial through a glass-lined transfer line to a trap packed with suitable sorbent materials.

7.2.4 Sample Desorption

7.2.4.1 Non-cryogenic interface - After the 11 minute purge, place the purge-and-trap system in the desorb mode and preheat the trap to 245°C without a flow

of desorption gas. Start the flow of desorption gas at 10 mL/minute for about four minutes (1.5 min is normally adequate for analytes in Method 8015). Begin the temperature program of the gas chromatograph and start data acquisition.

7.2.4.2 Cryogenic interface - After the 11 minute purge, place the purge-and-trap system in the desorb mode, make sure that the cryogenic interface is at -150°C or lower, and rapidly heat the trap to 245°C while backflushing with an inert gas at 4 mL/minute for about 5 minutes (1.5 min is normally adequate for analytes in Methods 8015). At the end of the 5-minute desorption cycle, rapidly heat the cryogenic trap to 250°C. Begin the temperature program of the gas chromatograph and start the data acquisition.

7.2.5 Trap Reconditioning

After desorbing the sample for 4 minutes, recondition the trap by returning the purge-and-trap system to the purge mode. Maintain the trap temperature at 245°C (or other temperature recommended by the manufacturer of the trap packing materials). After approximately 10 minutes, turn off the trap heater and halt the purge flow through the trap. When the trap is cool, the next sample can be analyzed.

7.2.6 Data Interpretation

Perform qualitative and quantitative analysis following the guidance given in the determinative method and Method 8000. If the concentration of any target analyte exceeds the calibration range of the instrument, it will be necessary to reanalyze the sample by the high concentration method. Such reanalyses need only address those analytes for which the concentration exceeded the calibration range of the low concentration method. Alternatively, if a sample aliquot of 1-2 g was also collected (see Sec. 6.2.1.7), it may be practical to analyze that aliquot for the analytes that exceeded the instrument calibration range in the 5-g analysis. If results are to be reported on a dry weight basis, proceed to Sec. 7.5

7.3 High concentration method for soil samples with concentrations generally greater than 200 µg/kg.

The high concentration method for soil is based on a solvent extraction. A solid sample is either extracted or diluted, depending on sample solubility in a water-miscible solvent. An aliquot of the extract is added to organic-free reagent water containing surrogates and, if applicable, internal and matrix spiking standards, purged according to Method 5030, and analyzed by an appropriate determinative method. Wastes that are insoluble in methanol (i.e., petroleum and coke wastes) are diluted with hexadecane (see Sec. 7.3.8).

The specific sample preparation steps depend on whether or not the sample was preserved in the field. Samples that were <u>not</u> preserved in the field are prepared using the steps below, beginning at Sec. 7.3.1. If solvent preservation was employed in the field, then the preparation begins with Sec. 7.3.4.

7.3.1 When the high concentration sample is <u>not</u> preserved in the field, the sample consists of the entire contents of the sample container. Do not discard any supernatant liquids. Whenever practical, mix the contents of the sample container by shaking or other mechanical means without opening the vial. When shaking is not practical, quickly mix the contents of the vial with a narrow metal spatula and immediately reseal the vial.

7.3.2 If the sample is from an unknown source, perform a solubility test before proceeding. Remove several grams of material from the sample container. Quickly reseal the container to minimize the loss of volatiles. Weigh 1-g aliquots of the sample into several test tubes or other suitable containers. Add 10 mL of methanol to the first tube, 10 mL of PEG to the second, and 10 mL of hexadecane to the third. Swirl the sample and determine if it is soluble in the solvent. Once the solubility has been evaluated, discard these test solutions. If the sample is soluble in either methanol or PEG, proceed with Sec. 7.3.3. If the sample is only soluble in hexadecane, proceed with Sec. 7.3.8.

7.3.3 For soil and solid waste samples that are soluble in methanol, add 9.0 mL of methanol and 1.0 mL of the surrogate spiking solution to a tared 20-mL vial. Using a top-loading balance, weigh 5 g (wet weight) of sample into the vial. Quickly cap the vial and reweigh the vial. Record the weight to 0.1 g. Shake the vial for 2 min. If the sample was not soluble in methanol, but was soluble in PEG, employ the same procedure described above, but use 9.0 mL of PEG in place of the methanol. Proceed with Sec. 7.3.5.

NOTE: The steps in Secs. 7.3.1, 7.3.2, and 7.3.3 must be performed rapidly and without interruption to avoid loss of volatile organics. These steps must be performed in a laboratory free from solvent fumes.

7.3.4 For soil and solid waste samples that were collected in methanol or PEG (see Sec. 6.2.2), weigh the vial to 0.1 g as a check on the weight recorded in the field, add the surrogate spiking solution to the vial by injecting it through the septum, shake for 2 min, as described above, and proceed with Sec. 7.3.5.

7.3.5 Pipet approximately 1 mL of the extract from either Sec. 7.3.3 or 7.3.4 into a GC vial for storage, using a disposable pipet, and seal the vial. The remainder of the extract may be discarded. Add approximately 1 mL of methanol or PEG to a separate GC vial for use as the method blank for each set of samples extracted with the same solvent.

7.3.6 The extracts must be stored at 4°C in the dark, prior to analysis. Add an appropriate aliquot of the extract (see Table 2) to 5.0 mL of organic-free reagent water and analyze by Method 5030 in conjunction with the appropriate determinative method. Proceed to Sec. 7.0 in Method 5030 and follow the procedure for purging high concentration samples.

7.3.7 If results are to be reported on a dry weight basis, determine the dry weight of a separate aliquot of the sample, using the procedure in Sec. 7.5, after the sample extract has been transferred to a GC vial and the vial sealed.

7.3.8 For solids that are not soluble in methanol or PEG (including those samples consisting primarily of petroleum or coking waste) dilute or extract the sample with hexadecane using the procedures in Sec. 7.0 of Method 3585.

7.4 High concentration method for oily waste samples

This procedure for the analysis of oily waste samples involves the dilution of the sample in methanol or PEG. However, care must be taken to avoid introducing any of the floating oil layer into the instrument. A portion of the diluted sample is then added to 5.0 mL of organic-free reagent water, purged according to Method 5030, and analyzed using an appropriate determinative method.

For oily samples that are not soluble in methanol or PEG (including those samples consisting primarily of petroleum or coking waste), dilute or extract with hexadecane using the procedures in Sec. 7.0 of Method 3585.

The specific sample preparation steps depend on whether or not the sample was preserved in the field. Samples that were not preserved in the field are prepared using the steps below, beginning at Sec. 7.4.1. If methanol preservation was employed in the field, then the preparation begins with Sec. 7.4.3.

7.4.1 If the waste was not preserved in the field and it is soluble in methanol or PEG, weigh 1 g (wet weight) of the sample into a tared 10-mL volumetric flask, a tared scintillation vial, or a tared culture tube. If a vial or tube is used instead of a volumetric flask, it must be calibrated prior to use. This operation must be performed prior to opening the sample vial and weighing out the aliquot for analysis.

7.4.1.1 To calibrate the vessel, pipet 10.0 mL of methanol or PEG into the vial or tube and mark the bottom of the meniscus.

7.4.1.2 Discard this solvent, and proceed with weighing out the 1-g sample aliquot.

7.4.2 Quickly add 1.0 mL of surrogate spiking solution to the flask, vial, or tube, and dilute to 10.0 mL with the appropriate solvent (methanol or PEG). Swirl the vial to mix the contents and then shake vigorously for 2 minutes.

7.4.3 If the sample was collected in the field in a vial containing methanol or PEG, weigh the vial to 0.1 g as a check on the weight recorded in the field, add the surrogate spiking solution to the vial by injecting it through the septum. Swirl the vial to mix the contents and then shake vigorously for 2 minutes and proceed with Sec. 7.4.4.

7.4.4 Regardless of how the sample was collected, the target analytes are extracted into the solvent along with the majority of the oily waste (i.e., some of the oil may still be floating on the surface). If oil is floating on the surface, transfer 1 to 2 mL of the extract to a clean GC vial using a Pasteur pipet. Ensure that no oil is transferred to the vial.

7.4.5 Add 10 - 50 µL of the methanol extract to 5 mL of organic-free reagent water for purge-and-trap analysis, using Method 5030.

7.4.6 Prepare a matrix spike sample by adding 10 - 50 µL of the matrix spike standard dissolved in methanol to a 1-g aliquot of the oily waste. Shake the vial to disperse the matrix spike solution throughout the oil. Then add 10 mL of extraction solvent and proceed with the extraction and analysis, as described in Secs. 7.4.2 - 7.4.5. Calculate the recovery of the spiked analytes as described in Method 8000. If the recovery is not within the acceptance limits for the application, use the hexadecane dilution technique in Sec. 7.0 of Method 3585.

7.5 Determination of % Dry Weight

If results are to be reported on a dry weight basis, it is necessary to determine the dry weight of the sample.

NOTE: It is highly recommended that the dry weight determination only be made after the analyst has determined that no sample aliquots will be taken from the 60-mL vial for high

concentration analysis. This is to minimize loss of volatiles and to avoid sample contamination from the laboratory atmosphere. There is no holding time associated with the dry weight determination. Thus, this determination can be made any time prior to reporting the sample results, as long as the vial containing the additional sample has remained sealed and properly stored.

7.5.1 Weigh 5-10 g of the sample from the 60-mL VOA vial into a tared crucible.

7.5.2 Dry this aliquot overnight at 105°C. Allow to cool in a desiccator before weighing. Calculate the % dry weight as follows:

$$\%\ \text{dry weight} = \frac{\text{g of dry sample}}{\text{g of sample}} \times 100$$

WARNING: The drying oven should be contained in a hood or vented. Significant laboratory contamination may result from a heavily contaminated hazardous waste sample.

8.0 QUALITY CONTROL

8.1 Refer to Chapter One for specific quality control procedures and Method 5000 for sample preparation QC procedures.

8.2 Before processing any samples, the analyst should demonstrate through the analysis of an organic-free reagent water method blank that all glassware and reagents are interference free. Each time a set of samples is extracted, or there is a change in reagents, a method blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement.

8.3 Initial Demonstration of Proficiency - Each laboratory must demonstrate initial proficiency with each sample preparation and determinative method combination it utilizes, by generating data of acceptable accuracy and precision for target analytes in a clean matrix. The laboratory must also repeat this demonstration whenever new staff are trained or significant changes in instrumentation are made. See Sec. 8.0 of Methods 5000 and 8000 for information on how to accomplish this demonstration.

8.4 Sample Quality Control for Preparation and Analysis - See Sec. 8.0 in Method 5000 and Method 8000 for procedures to follow to demonstrate acceptable continuing performance on each set of samples to be analyzed. These include the method blank, either a matrix spike/matrix spike duplicate or a matrix spike and duplicate sample analysis, a laboratory control sample (LCS), and the addition of surrogates to each sample and QC sample.

8.5 It is recommended that the laboratory adopt additional quality assurance practices for use with this method. The specific practices that are most productive depend upon the needs of the laboratory and the nature of the samples. Whenever possible, the laboratory should analyze standard reference materials and participate in relevant performance evaluation studies.

9.0 METHOD PERFORMANCE

9.1 Single laboratory accuracy and precision data were obtained for the method analytes in three soil matrices, sand, a soil collected 10 feet below the surface of a hazardous landfill, called the

C-Horizon, and a surface garden soil. Each sample was fortified with the analytes at a concentration of 20 ng/5 g, which is equivalent to 4 µg/kg. These data are listed in tables found in Method 8260.

9.2 Single laboratory accuracy and precision data were obtained for certain method analytes when extracting oily liquid using methanol as the extraction solvent. The data are presented in a table in Method 8260. The compounds were spiked into three portions of an oily liquid (taken from a waste site) following the procedure for matrix spiking described in Sec. 7.4. This represents a worst case set of data based on recovery data from many sources of oily liquid.

10.0 REFERENCES

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TABLE 1

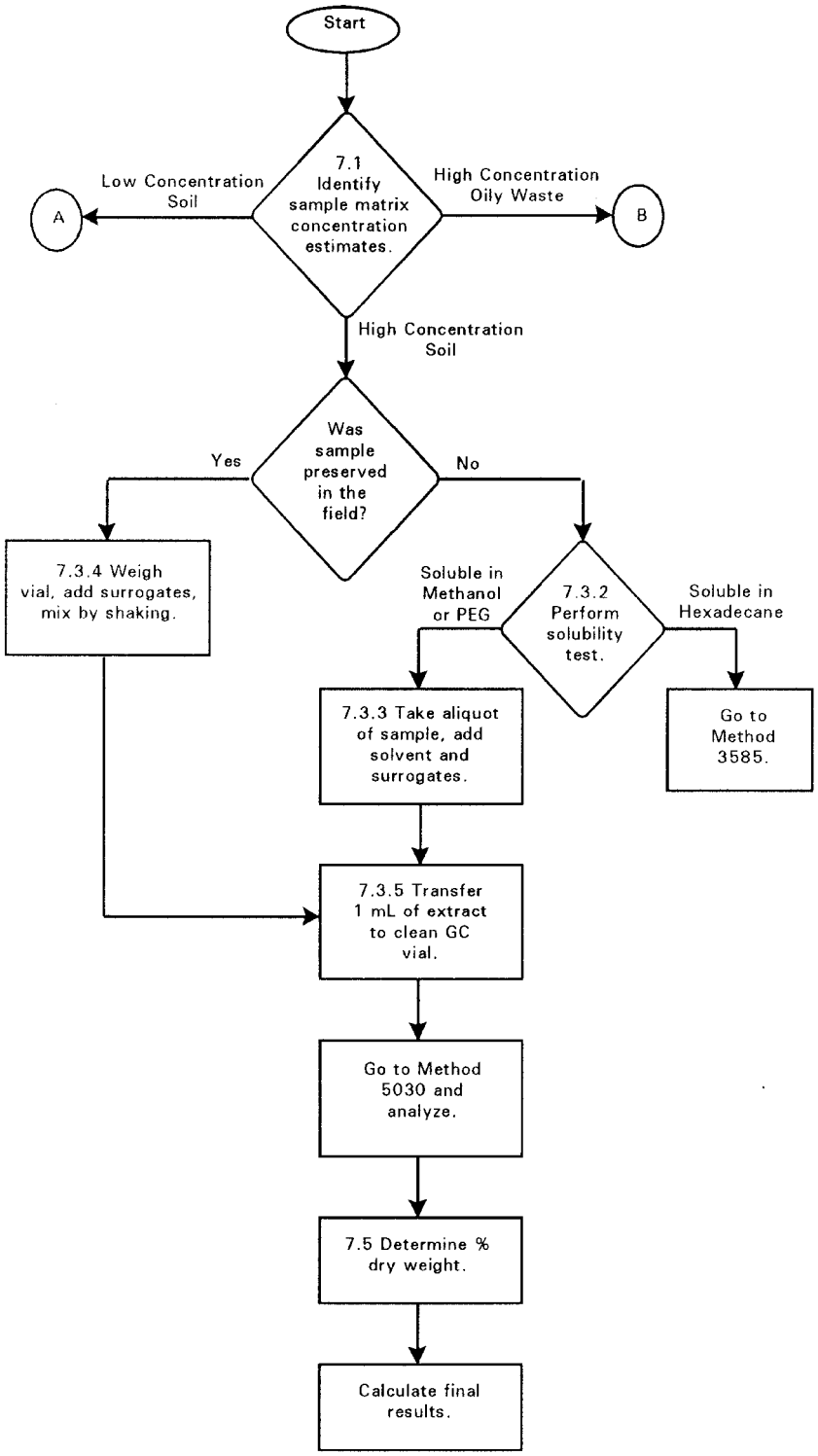
QUANTITY OF METHANOL EXTRACT REQUIRED FOR ANALYSIS OF HIGH CONCENTRATION SOILS/SEDIMENTS

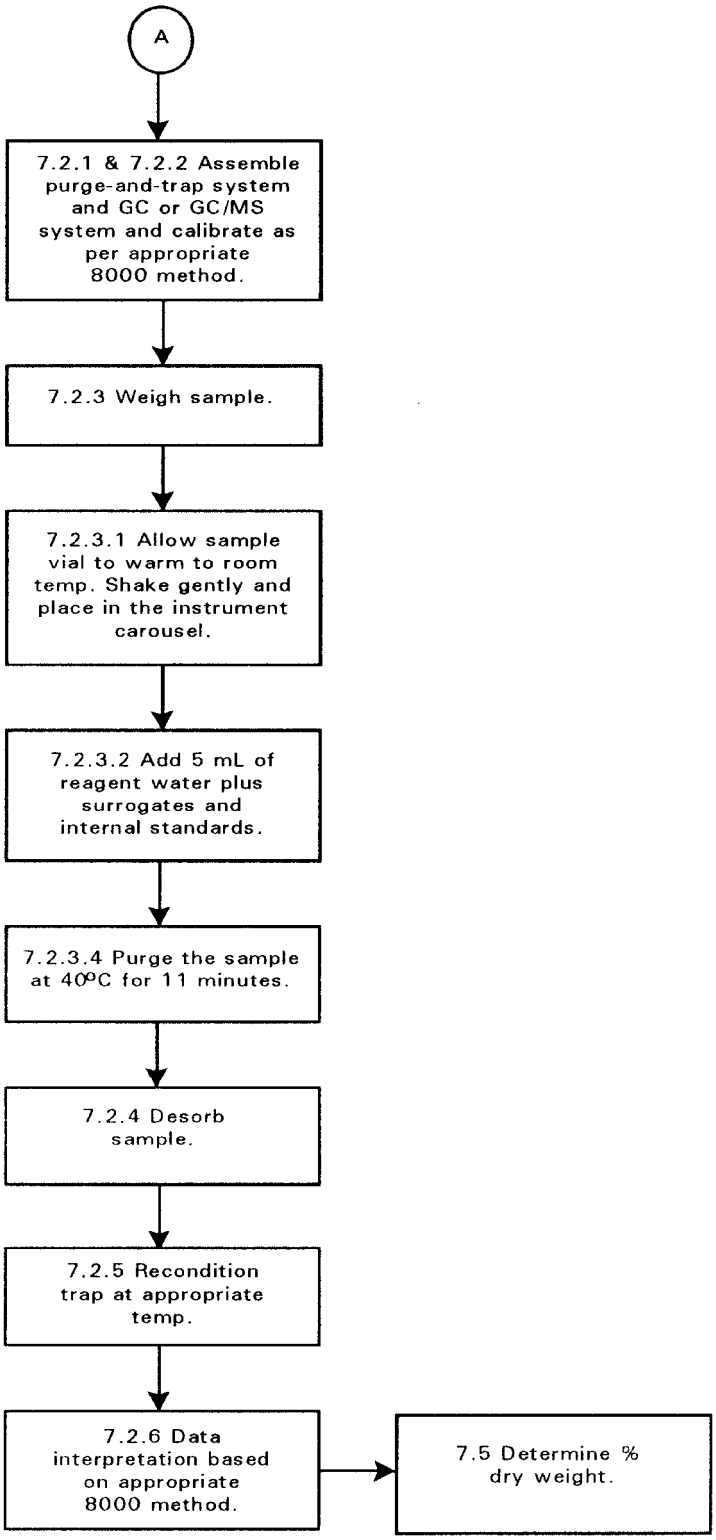
Approximate Concentration Range	Volume of Methanol Extract[a]
500 - 10,000 µg/kg	100 µL
1,000 - 20,000 µg/kg	50 µL
5,000 - 100,000 µg/kg	10 µL
25,000 - 500,000 µg/kg	100 µL of 1/50 dilution[b]

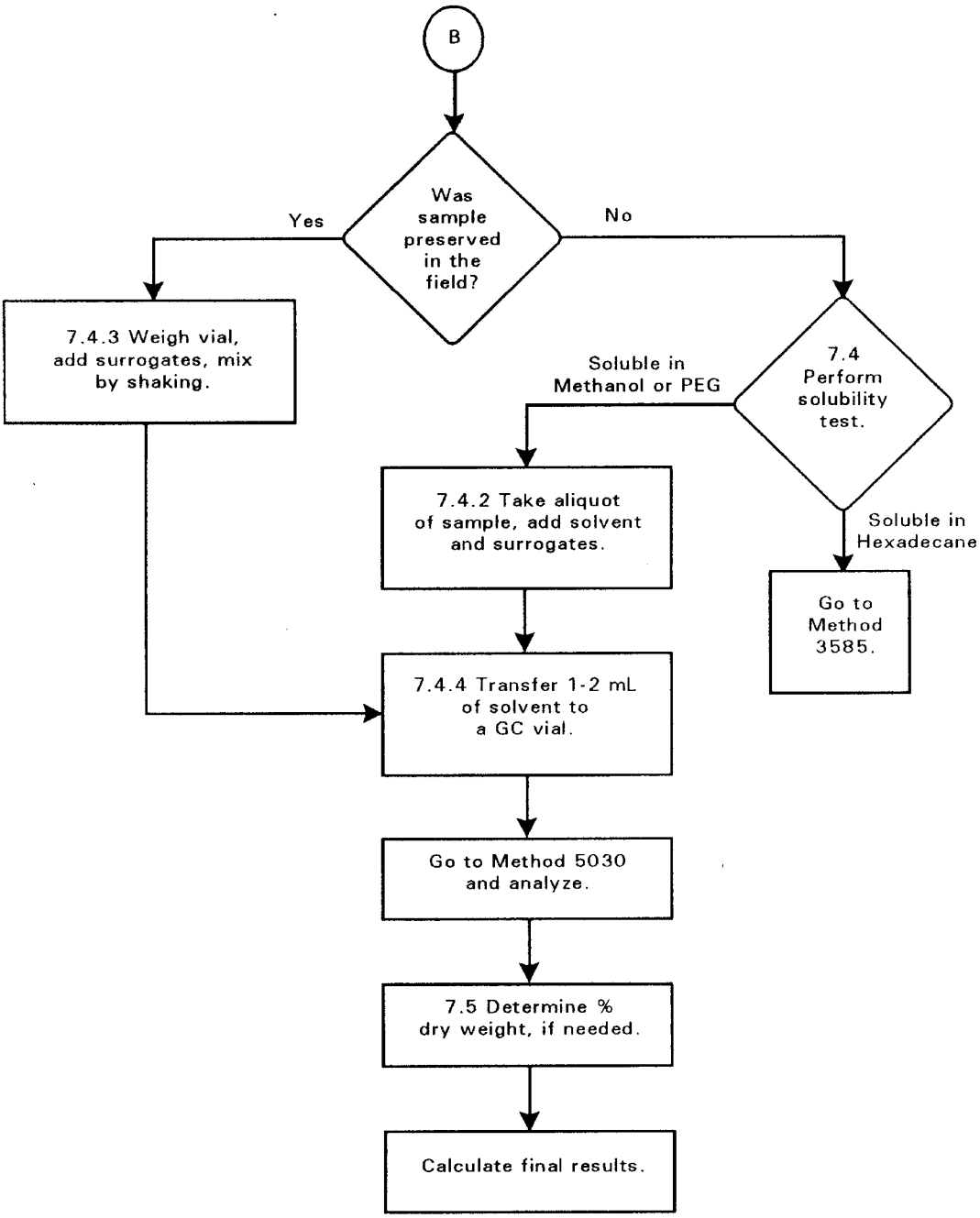
Calculate appropriate dilution factor for concentrations exceeding those in this table.

[a] The volume of methanol added to 5 mL of water being purged should be kept constant. Therefore, add to the 5-mL syringe whatever volume of methanol is necessary to maintain a total volume of 100 µL of methanol.

[b] Dilute an aliquot of the methanol extract and then take 100 µL for analysis.


Start
7.1 Identify sample matrix concentration estimates.
Low Concentration Soil
A
High Concentration Oily Waste
B
High Concentration Soil
Was sample preserved in the field?
Yes
No
7.3.4 Weigh vial, add surrogates, mix by shaking.
7.3.2 Perform solubility test.
Soluble in Methanol or PEG
Soluble in Hexadecane
7.3.3 Take aliquot of sample, add solvent and surrogates.
Go to Method 3585.
7.3.5 Transfer 1 mL of extract to clean GC vial.
Go to Method 5030 and analyze.
7.5 Determine % dry weight.
Calculate final results.


A
7.2.1 & 7.2.2 Assemble purge-and-trap system and GC or GC/MS system and calibrate as per appropriate 8000 method.
7.2.3 Weigh sample.
7.2.3.1 Allow sample vial to warm to room temp. Shake gently and place in the instrument carousel.
7.2.3.2 Add 5 mL of reagent water plus surrogates and internal standards.
7.2.3.4 Purge the sample at 40°C for 11 minutes.
7.2.4 Desorb sample.
7.2.5 Recondition trap at appropriate temp.
7.2.6 Data interpretation based on appropriate 8000 method.
7.5 Determine % dry weight.


B
Was sample preserved in the field?
Yes
No
7.4.3 Weigh vial, add surrogates, mix by shaking.
7.4 Perform solubility test.
Soluble in Methanol or PEG
Soluble in Hexadecane
7.4.2 Take aliquot of sample, add solvent and surrogates.
Go to Method 3585.
7.4.4 Transfer 1-2 mL of solvent to a GC vial.
Go to Method 5030 and analyze.
7.5 Determine % dry weight, if needed.
Calculate final results.

APPENDIX B
LOGGING FORMS

GEOLOGIC DATA COLLECTION BOOK No. ____

COMPANY NAME: _____

PROJECT NUMBER: _____

TEST PIT/
BOREHOLE / WELL ID: _____

CLIENT / PROJECT: _____

PROJECT LOCATION: _____

SITE NAME / No.: _____

SUBSITE NAME / No.: _____

DATES LOGGED: _____ TO _____

LOGGED BY: _____

_____

_____

TOTAL PAGES IN BOOK: _____

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CLIENT: _____ DATE: _____

PROJECT: _____ METHOD: TAPE - POPPER - SONIC - ELECTRIC - MECHANICAL

SITE: _____

MEASURED BY: _____ OTHER: _____

LOCATION ID	TIME	DEPTH TO WATER (ft)	DEPTH TO PRODUCT (ft)	DEPTH TO BOTTOM (ft)	BOTTOM CONDITION CODE	MEASURING POINT STICKUP (ft)		LEVEL STATUS CODE	LOCATION TYPE CODE	MEASURING POINT CODE

LOCATION TYPE CODE

BUC - UNCASED BORING
WOH - OPEN HOLE WELL
WSC - SCREENED WELL OR PIEZOMETER
TPO - OPEN TEST PIT
STR - RIVER/STREAM
SPR - SPRING/SEEP
OLT - OTHER: _____

LEVEL STATUS CODE

STA - STATIC
WDV - WELL DEVELOPMENT
PPR - POST PURGE
TPP - PUMPING WELL DURING PUMP TEST
TPO - OBSERVATION WELL DURING PUMPING TEST
TSR - RISING HEAD SLUG TEST
TSF - FALLING HEAD SLUG TEST
TAP - PUMPING ZONE DURING PACKER TEST
TAO - OBSERVATION ZONE DURING PACKER TEST
OLS - OTHER: _____

MEASUREMENT POINT CODE

TIC - TOP OF INNER CASING
TOC - TOP OF OUTER CASING
ELM - ELEVATION MARKER
GRS - GROUND SURFACE
OMP - OTHER: _____

BOTTOM CONDITION CODE

FRM - FIRM BOTTOM
SFT - SOFT BOTTOM
DRY - DRY BOTTOM, NO WATER

FIELD MEASUREMENT CODE

MTP - TEMPERATURE
MSC - SPECIFIC CONDUCTANCE
MPO - PHOTOIONIZER (eg., HNu)
MPD - FLAME IONIZER(eg., OVA)
MDO - DISSOLVED OXYGEN
MPH - pH
MEH - eH
MOT - OTHER: _____

DATA ENTRY BY: _____
DATE ENTERED: _____
QC REPORTS PRINTED? YES - NO

QC REVIEW BY: _____
REVIEW DATE: _____
APPROVED WITH - WITHOUT REVISIONS

QA REVIEW BY: _____
REVIEW DATE: _____
APPROVED WITH - WITHOUT REVISIONS

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CLIENT: _____ DRILLING COMPANY: _____

PROJECT / JOB No.: _____ DRILLER: _____

LOCATION: _____ HELPER / CREW: _____

BOREHOLE / WELL No.: _____ DRILL RIG TYPE: _____

LOGGED BY: _____ APPROVED BY: _____

DATE	TIME START - END	RIG ACTIVITY	DRILLING METHOD	TOOL/HOLE DIAM.(IN)	SAMPLING METHOD	FOOTAGE	EXPLANATION
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						
	-						

RIG ACTIVITIES

DRS = DRILLING / SAMPLING
STY = STANDBY
DNT = DOWNTIME
WLI = WELL INSTALLATION
DCN = DECONTAMINATION
WDV = WELL DEVELOPMENT
GRT = GROUTING
SPR = SITE PREPARATION
TST = TESTING
MOB = MOBILIZATION
WKB = WORK BREAK
OTH = OTHER

DRILLING METHODS

HSA = HOLLOW STEM AUGERING
MDR = MUD ROTARY
AIR = AIR ROTARY
RTF = ROTARY FLUSH
CBT = CABLE TOOL
REM = REAMING
DCD = DRILL THROUGH CASING DRIVER
BKA = BUCKET AUGER
COR = CORING
RVC = REVERSE CIRCULATION
DHH = DOWNHOLE HAMMER
OTH = OTHER

SAMPLING (TESTING) METHODS

CTS = CONTINUOUS TUBE SAMPLING
SSS = SPLIT SPOON SAMPLING
STS = SHELBY TUBE SAMPLING
CUT = SAMPLING FROM CUTTINGS
COR = CORING
WTS = WATER SAMPLING
PKT = PACKER TESTING
BGP = BOREHOLE GEOPHYSICS
PMT = PUMPING TESTING
SGT = SLUG TESTING
OTH = OTHER

SUPPORT SERVICES			DRILLING / WELL SUPPLIES			
SERVICE TYPE	DATE	HOURS	DATE	QUANTITY	UNIT	TYPE / SIZE

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CLIENT: _____ MEASURED BY: _____

PROJECT: _____ DEVELOPMENT METHOD: _____

SITE: _____

WELL ID: _____

DATE: _____ COMMENTS: _____

ONE WELL VOLUME: _____ gallons WELL TD: _____ ft TOC

Well Volume (gallons/foot): 2-inch = 0.16 6-inch = 1.47 4-inch = 0.65 8-inch = 2.61

TIME	WELL DEV. CODE	DEPTH TO WATER (ft)	PURGE RATE (gpm)	PURGE VOLUME (gal)	FIELD MEASUREMENTS				TURBIDITY	COMMENTS
	FINAL									

WELL DEVELOPMENT CODES		FIELD MEASUREMENT CODES	TURBIDITY
DOB - Begin Overpumping DOE - End Overpumping DRB - Begin Rawhiding DRE - End Rawhiding DSB - Begin Surge Blocking DSE - End Surge Blocking DJB - Begin Hydraulic Jetting DJE - End Hydraulic Jetting DFM - Field Measurements	DAB - Begin Air Surging DAE - End Air Surging DCB - Begin Recirculation DCE - End Recirculation DBB - Begin Bailing DBE - End Bailing DXB - Begin Other DXE - End Other Other: _____	MTP - Temperature MSC - Specific Conductance MPD - Photoionizer (eg., HNu) MFD - Flame Ionizer (eg., OVA) MDO - Dissolved Oxygen MPH - pH MEH - eH MOT - Other: _____	Enter Turbidity Meter Reading (Final should be < 5 NTU) OR Enter Qualitative Observations H - High: Muddy/Silty M - Medium: Cloudy/Translucent L - Low: Transparent N - None: Clear/No Sediment

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CLIENT: _____ DRILLING COMPANY: _____

SITE: _____ DRILLER / INSTALLER: _____

WELL ID: _____ INSPECTOR: _____

START DATE: _____

COMPLETION DATE: _____

UNIT SYSTEM: ENGLISH - METRIC

SURVEYED ELEVATIONS (MSL)

GROUND LEVEL: _____ FT/M

TOP OF CASING: _____ FT/M

DEPTH TO WATER	DATE
_____ FT/M(TOC)	_____
_____ FT/M(TOC)	_____
_____ FT/M(TOC)	_____

WELL DIAGRAM - NOT TO SCALE	DEPTH (FT. BGS)	WELL CODE
	0	GS

WELL TYPE: SCREENED - OPEN HOLE

CASING: SINGLE - DOUBLE - TRIPLE

WELL DESIGN CONSTRUCTION

CASING #1: DIAMETER: _____ IN/CM INTERVAL: _____ TO _____ FT/M BGS

TYPE: PVC: SCHEDULE 20 - 40 - 80 STEEL: STAINLESS - CARBON

CASING #2: DIAMETER: _____ IN/CM INTERVAL: _____ TO _____ FT/M BGS

TYPE: PVC: SCHEDULE 20 - 40 - 80 STEEL: STAINLESS - CARBON

CASING #3: DIAMETER: _____ IN/CM INTERVAL: _____ TO _____ FT/M BGS

TYPE: PVC: SCHEDULE 20 - 40 - 80 STEEL: STAINLESS - CARBON

STICK UP: INNER CASING: _____ FT/M OUTER CASING: _____ FT/M

CASING GROUT: TYPE: PORTLAND CEMENT - CEMT/BENT - BENTONITE - HI SOL BENT

OTHER: _____

INTERVAL: _____ TO _____ FT/M BGS

WELL T.D.: DEPTH: _____ FT/M BGS BACKFILLED ? YES - NO

BACKFILL: INTERVAL: _____ TO _____ FT/M BGS TYPE: _____

BEDROCK ELEVATION: TOP OF BEDROCK: _____ FT/M BGS

OPEN HOLE: DIAMETER: _____ IN/CM INTERVAL: _____ TO _____ FT/M BGS

SEAL: TYPE: _____ INTERVAL: _____ TO _____ FT/M BGS

SAND PACK: TYPE: _____ INTERVAL: _____ TO _____ FT/M BGS

GRAIN SIZE: UNIFORM - MIXED MEDIAN DIAMETER: _____ IN/MM

SCREEN: DIAMETER: _____ IN/MM INTERVAL: _____ TO _____ FT/M BGS

TYPE: PVC - STAINLESS - OTHER: _____

SLOTS: CONTINUOUS - MACHINE/BRIDGE - FIELD CUT

SLOT DIAMETER: 6 - 10 - 20 - 30 - 40 SLOT _____ IN/MM

SILT TRAP: YES - NO INTERVAL: _____ TO _____ FT/M BGS

WELL DEVELOPMENT

DATE: _____ RATE: _____ GPM/LPM VOLUME: _____ GAL/L

METHOD: _____

WELL CONSTRUCTION CODES

GS = GROUND SURFACE
PC = BOTTOM OF PROTECTIVE CASING
BN = TOP OF BENTONITE SEAL
BR = TOP OF BEDROCK
OC = BOTTOM OF OUTER CASING
SP = TOP OF SAND PACK
SC = TOP OF SCREEN
ST = TOP OF SILT TRAP
TD = WELL TOTAL DEPTH
TOC = TOP OF CASING (INNER)
BGS = BELOW GROUND SURFACE
MSL = MEAN SEA LEVEL

COMMENTS: _____

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CLIENT: _____ DATE: _____

SITE: _____ LOGGER: _____

BOREHOLE NO.: _____ SIGNATURE: _____

SAMPLING METHOD: OVERBURDEN: SSS - STS - CTS - CUT - COR
NOT SAMPLED
BEDROCK: CUT - COR
OTHER: _____

RQD: _____ % NA

WATER ENTRY ZONES: _____ FT/M BGS _____ GPM
_____ FT/M BGS _____ GPM

SAMPLING INTERVAL: _____ TO _____ FT/M BGS

RECOVERY: _____ / _____ FT/M NA

BLOW COUNT: [ ] [ ] [ ] [ ] / [ ] IN/CM NA

ANALYTICAL SAMPLE ID	INTERVAL (FT/M BGS)	TYPE
	-	
	-	

SAMPLING INTERVAL No.: _____

LITHOLOGIC INTERVAL No.: _____

LITHOLOGIC INTERVAL: _____ TO _____ FT/M BGS NO RECOVERY

MATERIAL: NATURAL - FILL - UNCERTAIN

OBSERVED: SHN - ODR - PRD - NA - OTHER: _____

INSTRUMENT 1 TYPE: _____ READING: _____

INSTRUMENT 2 TYPE: _____ READING: _____

OVERBURDEN

SECONDARY TYPE: NA - BED - CLS - MIX

COLOR: MUN - GSA _____

COLORATION: UNI - STN - MOT - VAR

TEXTURE:
- GRAVEL: C - M - F _____ %
- SAND: C - M - F _____ %
- SILT: _____ %
- CLAY: _____ %
- ORGANIC: _____ %

ROUNDNESS:
- GRAVEL: FAC - STR - ANG - SUB - RND - NA
- SAND: ANG - SUB - RND - NA

SORTING: WEL - MOD - POR - NA

PLASTICITY: NON - LOW - MOD - HGH - NA

MOISTURE: DRY - MST - WET - SAT

CEMENTATION: NON - SLT - MOD - WEL

GRAIN TYPE: QTZ - FRG - FOS - NA

MATRIX: CAL - OXD - ARG - SIL - NA

STRENGTH: STF - FRM - SFT - LSE - NA

UPPER CONTACT: SHP - GRD - DIF - SME - NA

BEDDING:
- THICKNESS: _____ IN/CM
- NUMBER: _____
- TYPE: XBD - RPL - HOR - INC - NA
  MAS - LNS - LAM - GRU - GRD

SECONDARY

GRAPHIC LOG

BEDROCK

SECONDARY TYPE: NA - BED - CLS - MIX

COLOR: MUN - GSA _____

ROCK TYPE: OTHER: _____
- SED: SHL - SLT - SST - CGL - LST - DOL - COL
- MET: SLA - PHY - SHS - GNS - HRN - QZT - MBL
- IGN: GRN - RHY - BSL - GBR - TUF - BRC

TEXTURE: NA
- GRAVEL: C - M - F _____ %
- SAND: C - M - F _____ %
- SILT: _____ %
- CLAY: _____ %

GRAIN TYPE: QTZ - FRG - FOS - NA

MATRIX: CAL - OXD - ARG - SIL - ORG - NA

STRENGTH: EWK - VWK - WEK - MOD
STR - VST - EST

UPPER CONTACT: SHP - GRD - DIF - SME - NA

SECONDARY POROSITY: VUG - FRC - BED - NA - OTHER
HGH - MOD - LOW

WEATHERING: FRS - SLT - MOD - HGH - CPL - NA

SECONDARY

STRAT UNIT: _____

NOTE LINE: _____

NEXT INTERVAL: SAMP/LITH No. _____ / _____ INTERVAL _____ TO _____
NOT SAMPLED NO RECOVERY

NATURAL FRACTURING

INTERVAL (FT/M BGS)	#/FT-M	DIP	DIR	FILL / SHAPE / ROUGH
-				FILL: OPN - PRT - FUL SHAPE: PLN - CUR - UND - STP - IRR ROUGH: SMH - MOD - RGH
-				FILL: OPN - PRT - FUL SHAPE: PLN - CUR - UND - STP - IRR ROUGH: SMH - MOD - RGH
-				FILL: OPN - PRT - FUL SHAPE: PLN - CUR - UND - STP - IRR ROUGH: SMH - MOD - RGH
-				FILL: OPN - PRT - FUL SHAPE: PLN - CUR - UND - STP - IRR ROUGH: SMH - MOD - RGH
-				FILL: OPN - PRT - FUL SHAPE: PLN - CUR - UND - STP - IRR ROUGH: SMH - MOD - RGH

COMMENTS: _____

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CLIENT: _____

PROJECT NAME / No.: _____

PROJECT LOCATION: _____

SITE NAME / No.: _____

LOCATION TYPE: WELL - BOREHOLE - TEST PIT

BOREHOLE / WELL ID: _____

BEGIN DATE: _____

END DATE: _____

LOGGER: _____

QUALITY LEVEL: 1 - 2 - 3

UNIT SYSTEM: ENGLISH - METRIC

TEST PIT: LENGTH: _____ FT/M WIDTH: _____ FT/M

BOREHOLE COMPLETED IN: OVERBURDEN - BEDROCK

TOTAL DEPTH: _____ FT/M BGS

DEPTH TO BEDROCK: _____ FT/M BGS

BOREHOLE DIAMETER No.1: _____ IN/CM

INTERVAL: _____ TO _____ FT/M BGS

METHOD: HSA SSA BKA JET
DRT RRT COR
CBT DCD DHH
OTHER : _____

FLUID: AIR WATER MUD FOAM NONE

BOREHOLE DIAMETER No.2: _____ IN/CM

INTERVAL: _____ TO _____ FT/M BGS

METHOD: HSA SSA BKA JET
DRT RRT COR
CBT DCD DHH
OTHER : _____

FLUID: AIR WATER MUD FOAM NONE

BOREHOLE DIAMETER No.3: _____ IN/CM

INTERVAL: _____ TO _____ FT/M BGS

METHOD: HSA SSA BKA JET
DRT RRT COR
CBT DCD DHH
OTHER : _____

FLUID: AIR WATER MUD FOAM NONE

DRILLING COMPANY: _____

DRILLER: _____

DRILL RIG TYPE:

SITE SKETCH

	ESTIMATED	SURVEYED
SURFACE ELEVATION:	_____	_____
N. COORDINATE:	_____	_____
E. COORDINATE:	_____	_____

WELL PERMIT No.: _____

HOLE ABANDONED ? YES - NO

WELL INSTALLED ? YES - NO

WELL CLUSTER ? YES - NO No. OF WELLS: _____

WELL NEST ? YES - NO No. OF WELLS: _____

PUMPS INSTALLED ? YES - NO

	TYPE	DEPTH
PURGE:	_____	_____
SAMPLE:	_____	_____

BOREHOLE TESTING

BOREHOLE GEOPHYSICS ? YES - NO

SLUG TESTS ? YES - NO

PACKER TESTS ? YES - NO

PUMPING TESTS ? YES - NO

COMMENTS: _____

DATA ENTRY BY: _____
DATE ENTERED: _____
QC REPORTS PRINTED ? YES - NO

QC REVIEW BY: _____
REVIEW DATE: _____
APPROVED WITH - WITHOUT REVISIONS

QA REVIEW BY: _____
REVIEW DATE: _____
APPROVED WITH - WITHOUT REVISIONS

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GEOLIS® Well Purging Form

COMPANY: _____ LOCATION ID: _____

CLIENT: _____ DATE: _____

PROJECT: _____ SAMPLER: _____

SITE / AREA: _____ SIGNATURE: _____

WELL OBSERVATIONS

CASING & LID: OK - DAMAGED - HEAVED - NO LID LOCKED: YES - NO KEY NO: _____ STICKUP: _____ FT-M

WELL DIAMETER: 2" - 4" - 6" - 8" - OTH: _____ BOREHOLE DIAMETER: _____ IN-CM MEASURING POINT: TIC - TOC - GRS

VAPOR READINGS: PID - FID - OTHER: _____ BACKGROUND: _____ INSIDE WELL: _____

CHECKED FOR NAPL LAYER: YES - NO OBSERVED: NON - FLT - SNK THICKNESS: _____ IN-CM SHEEN: YES - NO

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: _____ FT-M BMP

(B) DEPTH TO WATER: _____ FT-M BMP

(C) SAND PACK LENGTH _____ FT-M

(D) WATER COLUMN HEIGHT (A - B): _____ FT-M

(E) CASING VOLUME FACTOR: _____ GPF-LPM

(F) SAND PACK VOLUME FACTOR: _____ GPF-LPM

(G) CASING VOLUME (D x E): _____ GAL-L

(H) SAND PACK VOLUME (C x F): _____ GAL-L

Casing Factor (GPF for inches) = 0.041(Well Diameter)²

2" = 0.16; 4" = 0.65; 6" = 1.47; 8" = 2.61 GPF

Sand Pack Factor (GPF for inches)
= [0.041(Hole Diameter)² - 0.041(Well Diameter)²] 0.45

(I) TOTAL WELL VOLUME (G + H): _____ GAL-L

(J) VOLUMES TO BE PURGED: _____

(K) TOTAL PURGE VOLUME (I x J): _____ GAL-L

PURGING INFORMATION

PURGE ENDPOINT: VOLUME - TIME - PARAMETER STABILIZATION - TURBIDITY CRITERIA: _____

PURGING METHOD: BAILER - SUB. PUMP - CENT. PUMP - PACKER & PUMP - OTHER: _____

DEVICE DESCRIPTION: _____ DEVICE No.: _____

PUMP/BAILER INTAKE: SCREEN TOP - SCREEN/WELL BOTTOM - MID SCREEN/WELL - WATER LEVEL - MOVED UP/DOWN

PURGE WATER: DISCHARGED - TREATED - STORED ONSITE STORED IN: TANKS - DRUMS NO.: _____

FIELD MEASURMENTS IN: FLOW THRU CHAMBER - OPEN JAR CASCADING WATER: YES - NO DEPTH: _____ FT-M BMP

WELL PURGING INTERVAL: _____ TO _____ FT-M BMP PURGE DEPTH TO WATER (MAX): _____ FT-M BMP

TIME	DEPTH TO WATER (FT-M BMP)	PURGE RATE or VOLUME (GPM-GAL)	TURBID-ITY (NTU)	FIELD MEASUREMENTS AND UNITS						COMMENTS
				MTP °C.						
										Pre Purge Readings
										Post Purge Readings

TOTAL PURGE TIME: _____ HRS TOTAL PURGE VOLUME: _____ GAL - L RECOVERY: FAST - SLOW - V.SLOW

FIELD MEASUREMENT CODES

MTP - Temperature (°C.)
MSC - Specific Conductance (mS/cm)
MPD - Photoionizer (e.g., HNu)
MFD - Flame Ionizer (e.g., OVA)
MCL - Color
MPH - pH
MEH - Eh
MAL - Alkalinity
MDO - Dissolved Oxygen (mg/L)
MO1 - Other: _____
MO2 - Other: _____
MO3 - Other: _____
MD1 - DTW in Well _____
MD2 - DTW in Well _____
MD3 - DTW in Well _____
MD4 - DTW in Well _____

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GEOLIS® Water Sampling Form

COMPANY: _____ LOCATION ID: _____

PROJECT: _____ DATE: _____

PROPERTY: _____ SAMPLER: _____

SITE/AREA: _____ / _____ SIGNATURE: _____

SITE SKETCH

N

	ESTIMATED/GPS	SURVEYED
SURFACE ELEVATION:		
N. COORDINATE:		
E. COORDINATE:		

WELL PERMIT No.: _____

MEASURING POINT: TOC - TSG - WAT - OTH: _____

SAMPLING INFORMATION

SAMPLE ID: _____

COLLECTION TIME (24:00): : DURATION HRS:MIN: :

SAMPLE DEPTH FT-M BMP: _____ SAMPLING QTR/ROUND: _____

SAMPLE PURPOSE: BKG - SCR - RSK - RND - SDW - CON - OTH: _____

SAMPLE TYPE: DISCRETE - COMPOSITE - OTHER: _____

SAMPLING METHOD:

GROUNDWATER: BLO - BLC - PSB - PPR - PCN - PBL - NLF - MLS

SURFACE WATER BOT - KEM - BCB - SCP - TGS

OTHER: _____

SAMPLER DECONTAMINATION: DED - LAB - FLD - NON

(1)DET - (2)STM - (3)ACE - (4)HEX - (5)MET - (6)DIW - (7)POT - (8)NO3

(9)OTH: _____ SEQUENCE: _ _ _ _ _ _ _ _ _

SAMPLING PROCEDURES USED: NON - SAP/QAPP - SOP - OTH

REFERENCE: _____

QA SAMPLES: MS/MSD SAMPLE COLLECTED: YES - NO

DUPLICATE ID: _____

TRIP BLANK ID: _____

AMBIENT - RINSE BLANK ID: _____

CHAIN-OF-CUSTODY No.: _____

48 HOUR PRECIPITATION: NON - LTE - MOD - HVY

CUR - 8 - 16 - 24 - _____ HOURS PRIOR TO SAMPLING

WELL PURGE RECOVERY: _____ % OF INITIAL WATER LEVEL

SAMPLE DESCRIPTION

GROUNDWATER WOS - WBS - WBO - SUP - RES - BOR - HYD - SPR

SEP - PIT - SMP - OTH: _____

SURFACE WATER: TAL - LAK - PND - RVM - RVB - RVS - STP - STI - WET

OUB - INB - LAG - PIP - SWR - CUL - CHN - DCH - OTH: _____

SAMPLED: WATER - NAPL/PRODUCT - OTH: _____

WATER BODY/FORMATION NAME: _____

FLOW: FLD - FUL - LOW - POO - DRY - NA WIDTH: _____ FT-M

DEPTH: _____ FT-M VELOCITY: _____ FT/S-M/S

VELOCITY METHOD: MMB - PYG - DYE - OBJ - EST

WATER COLOR: CLR - LBN - MBN - DBN - TUR - GRE - STN

NAPL LAYER PRESENT: NO - FLT - SNK

THICKNESS _____ IN-CM SHEEN: YES - NO

DESCRIPTION _____

FIELD PARAMETERS:	UNITS	BEFORE	AFTER
TIME	24:00		
WATER LEVEL (BMP)	FT-M		
TEMPERATURE			
SP. CONDUCTANCE			
pH			
Eh			
DISS. OXYGEN			
PID / FID			
ALKALINITY			
TURBIDITY			

ANALYTICAL PARAMETERS

	LAB NAME
CHM: VOC - BNA - PES - PCB - HRB - PHE - TOC - UMT - FMT - ION - SOL - INO - OTH:	
CHM: VOC - BNA - PES - PCB - HRB - PHE - TOC - UMT - FMT - ION - SOL - INO - OTH:	
RAD/OTH: GAL - GBT - GGM - SAL - TRT - ASB - OTH:	

SPLIT SAMPLES: NON - CLI - OWN - OVR - OTH: _____ SPLIT SAMPLE ID NO.: _____

ORGANIZATION NAME: _____ PARAMETERS: SAME - OTHER: _____

REPRESENTATIVES NAME: _____ QA/QC SAMPLES: NON - COL - RNS - TRP - MSD

COMMENTS: _____

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19 November 2002

Mr. Kenneth Bardo
Project Manager
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: World Kitchen, Massillon, Ohio, Facility
U.S. EPA I.D. No. OHD 045-205-424
Consent Order Plans and Reports Volume 3

Dear Mr. Bardo:

On behalf of Wyeth and World Kitchen, Inc., please find attached two copies of the Consent Order Plans and Reports (COPR), Volume 3, which consists of the:

- Remediation Design Report (RDR).

Two copies of the COPR, Volume 2, were submitted to the U.S. EPA on 23 October 2002. The plans provided in Volume 2 included the:

- Quality Assurance Project Plan (QAPP)
- Sampling and Analysis Plan (SAP)
- Health and Safety Plan (HASP)

Two copies of the COPR, Volume 1, were submitted to the U.S. EPA on 9 October 2002. The plans that were provided in Volume 1 included the:

- Project Management Plan (PMP)
- Data Management Plan (DMP)
- Community Relations Plan (CRP)
- Institutional Control Plan (ICP)

The submission of Volumes 1, 2, and 3 meets the schedule and content requirements of the Consent Order and fulfills the reporting requirements for these plans set forth in Section IX, Paragraph 39b, Section VI, Paragraph 15; and Section 2 and Table 1 of Attachment 2 of the Consent Order. The Operation and Maintenance Plan/Construction Completion Report will be submitted to the U.S. EPA in the COPR, Volume 4, on or before 26 November 2003.

If you have any questions or comments regarding this submittal, please contact Tom Cornuet at (610) 701-7360 or Mr. Matthew Basso at (973) 683-2273.

Very truly yours,

WESTON SOLUTIONS, INC.

Thomas Cornuet

Thomas S. Cornuet, P.G.
Project Manager

Attachment

cc: M. Basso, Wyeth
J. Burman, WKI
L. Bove, WESTON
T. Stevens, WESTON
J. Savage, WESTON

Remediation Design Report
for the
World Kitchen, Inc. Massillon, Ohio Facility

U.S. EPA ID #OHD 045-205-424

November 2002

Prepared for

WYETH
Florham Park, New Jersey

Prepared by

Weston Solutions, Inc.
1400 Weston Way
West Chester, Pennsylvania 19380

W.O. No. 02994.002.009

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LIST OF ACRONYMS

AHP	American Home Products Corporation
AST	Aboveground Storage Tank
CMI	Corrective Measures Investigation
CMS	Corrective Measures Study
CRP	Community Relations Plan
COPR	Consent Order Plans and Reports
DCA	Dichloroethane
DDAGW	OEPA Division of Drinking and Groundwaters
DCE	Dichloroethene
DMP	Data Management Plan
EKCO	EKCO Housewares, Inc.
FBA	Floyd Brown and Associates, Inc.
GAC	Granular Activated Carbon
ICP	Institutional Control Plan
IRM	Interim Remedial Measures
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OVM	Organic Vapor Meter
PMP	Project Management Plan
PRG	Preliminary Remediation Goal
PTI	Permit to Install
PTO	Permit to Operate
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RDR	Remediation Design Report
RFI	RCRA Facility Investigation
RPM	RCRA Project Manager
ROI	Radius of Influence
SAP	Sampling and Analysis Plan
SVE	Soil Vapor Extraction
TCA	Trichloroethane
TCE	Trichloroethene
UIC	Underground Injection Control
U.S. EPA	United States Environmental Protection Agency
UST	Underground Storage Tank

LIST OF ACRONYMS

VC	Vinyl Chloride
VOC	Volatile Organic Compound
WESTON	Weston Solutions, Inc.
WKI	World Kitchen, Incorporated

1. INTRODUCTION

1.1 REPORT OBJECTIVES

On behalf of Wyeth, Weston Solutions, Inc. (WESTON®) has prepared this Remediation Design Report for the World Kitchen, Inc. (WKI) Massillon, Ohio, facility (U.S. EPA ID No. OHD 045-205-424). Wyeth is submitting this Remediation Design Report to the United States Environmental Protection Agency (U.S. EPA) in compliance with an Administrative Order on Consent (Consent Order) between U.S. EPA Region 5, WKI, the current facility owner; and Wyeth, the previous facility owner. This report fulfills reporting requirements set forth in Section VI, Paragraph 15, Section IX, Paragraph 39b, and Section 2 and Table 1 of Attachment 2 of the Consent Order.

This report is based on guidance provided in the RCRA Corrective Action Plan (U.S. EPA, 1994). The objective of this report is to present the design for the soil and groundwater remediation system at the WKI facility as described in Attachment 2 to the Consent Order, which contains the Scope of Work for Corrective Measures Implementation (CMI) under the Resource Conservation and Recovery Act (RCRA). The Consent Order requires implementation of the following corrective measures at the WKI facility:

- Pulse pumping of groundwater from on-site production wells W-1 and W-10 and treatment by air stripping. The locations of wells W-1 and W-10 are shown on Figure 1-1.
- Soil vapor extraction (SVE) in Area 1, Area 2, and Area 3 – East, outside the plant building, and Area 4 inside the building. These four areas are shown on Figure 1-1.
- Air sparging of shallow groundwater in Area 3 – East.

1.2 FACILITY OWNERSHIP

EKCO Housewares, Inc. (EKCO) owned and operated the Massillon, Ohio, facility until 1965, at which time it was acquired by American Home Products Corporation (AHP). AHP continued to operate the facility until 1984 when it was sold to the EKCO Group. In 1999, the EKCO Group

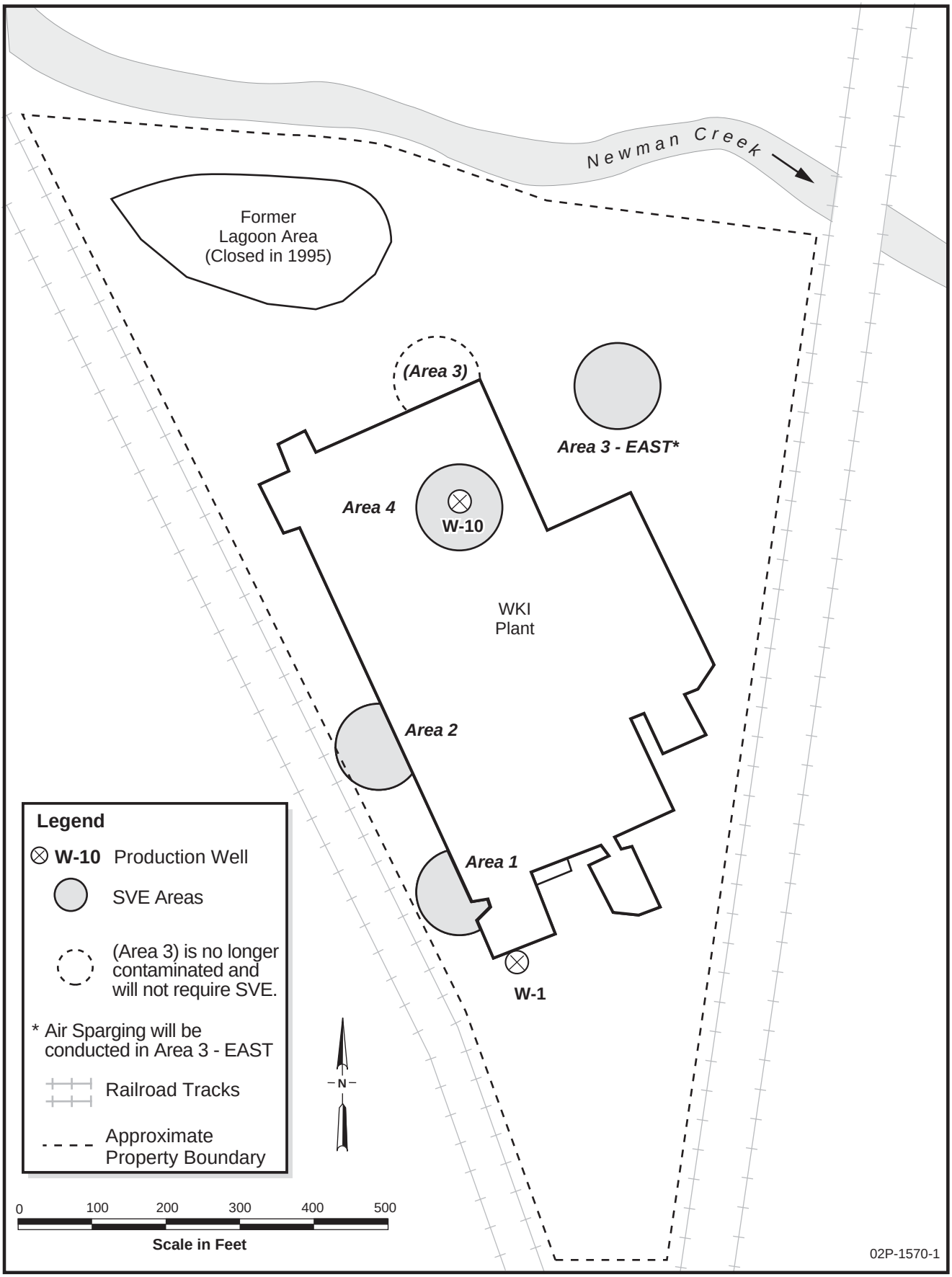


FIGURE 1-1 CORRECTIVE MEASURES AREAS
WKI MASSILLON, OHIO FACILITY

sold the facility to WKI, the current owner of the property. AHP changed its name to Wyeth in March 2002.

1.3 FACILITY DESCRIPTION

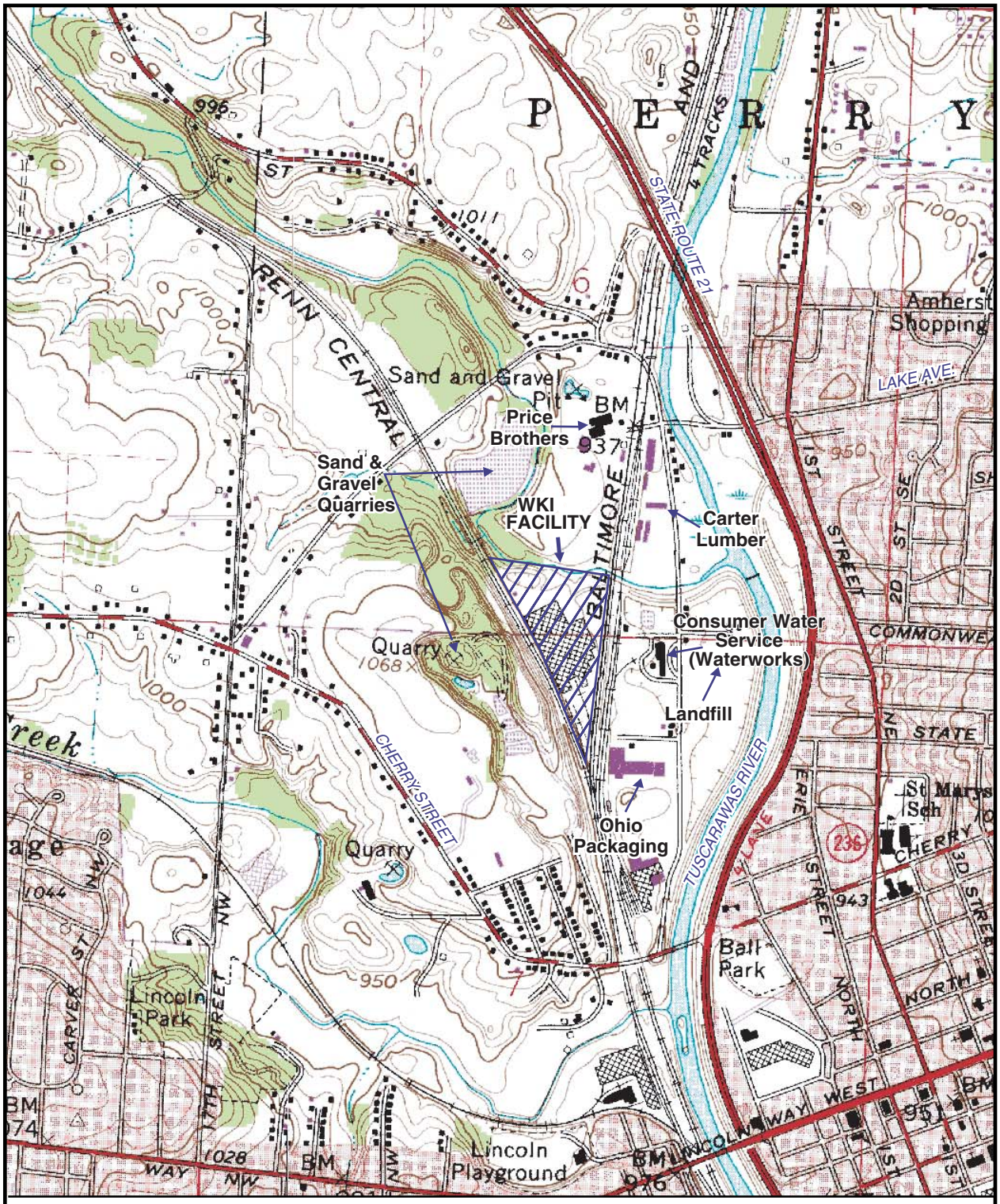
The facility occupies approximately 13 acres in the City of Massillon, Stark County, Ohio (Figure 1-2). The area surrounding the site is largely urban and industrial. Land use to the northwest is more rural with open space. The property is triangular in shape and lies approximately 1,500 feet west of the Tuscarawas River. The facility is bordered to the north by Newman Creek, while railroads border the property to the west and east, respectively. The railroad has numerous spurs and sidetracks adjacent to the plant, which are used for the storage of rail cars and track maintenance vehicles.

Manufacturing, warehousing, and shipping activities are conducted within a complex of interconnected buildings, which are shown on Figure 1-1. A variety of businesses operate in the immediate vicinity of the plant, as shown in Figure 1-2.

1.4 FACILITY HISTORY

The first recorded activities occurred at the facility in approximately 1929, when the property was owned by Standard Oil Company. From approximately 1929 to 1942 Fort Pitt/Massillon Bridge Works manufactured iron and steel bridges and structural iron. In 1945, the Massillon facility was manufacturing aluminum and stainless steel cookware. By 1951, with the United States' involvement in the Korean Conflict, the plant was manufacturing 90 mm and 105 mm shell casings for the military. The resulting increase in production necessitated the drilling of two production wells, W-1 and W-2, at the facility (Figure 1-3). In 1953, a sewer was constructed which carried the plant waste to a discharge point along Newman Creek. At approximately the same time, a surface impoundment was constructed along the northern property boundary adjacent to Newman Creek. Wastewaters from manufacturing were discharged to the surface impoundment.

During 1954, the facility began alternate manufacturing operations. The primary function of these operations was returned to manufacturing cookware at the facility. Solvents (primarily



0 1000 2000

Scale in Feet

Source: Massillon, Ohio
USGS Quadrangle 1970,
Photorevised 1990.

N

QUADRANGLE LOCATION

02P-1570-2

FIGURE 1-2 SITE LOCATION MAP
WKI MASSILLON, OHIO FACILITY

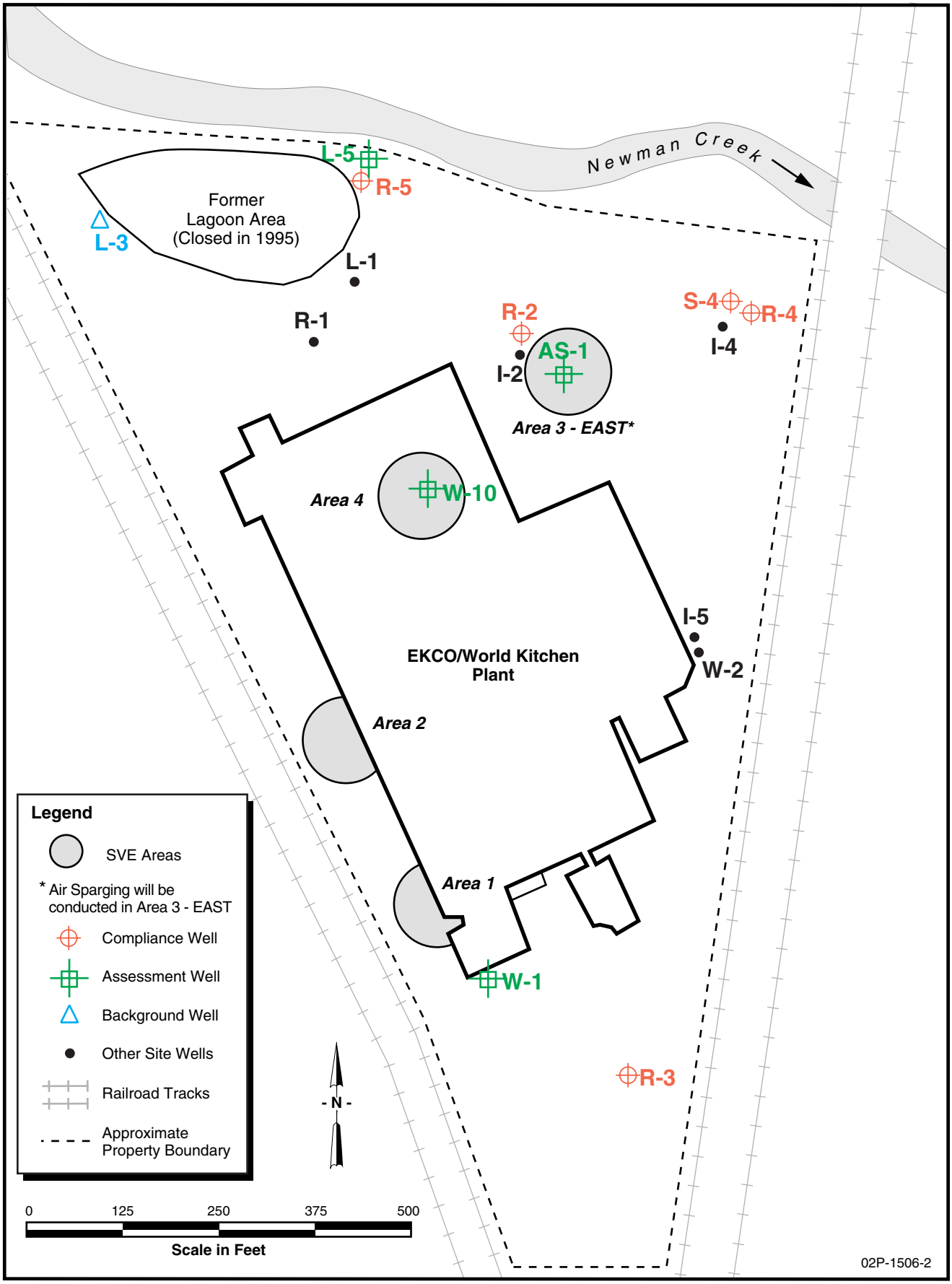


FIGURE 1-3 WORLD KITCHEN, INC. - MASSILLON, OHIO PROJECT GROUNDWATER MONITORING PROGRAM WELLS AND SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING AREAS

trichloroethene [TCE] or 1,1,1-trichloroethane [1,1,1-TCA]) were used to clean the products prior to continuing production. These solvents were used for cleaning purposes until 1994. In 1994, the solvents were replaced with a Borax aqueous cleaner which is still used at the facility. No chlorinated solvents have been used at the facility since 1994.

By 1967, trends in the cookware manufacturing industry had changed, resulting in the installation of porcelain- and Teflon-coating units. In 1969, with the development of new NPDES regulations and permit requirements, the surface impoundment was approved and permitted by the State of Ohio to accept waste products associated with plant activities. These waste products have included:

- Deionizers from plant operations (hydrochloric acid and sodium hydroxide).
- Washings and waste material from manufacturing porcelain-Teflon-coated aluminum cookware (aluminum frit, various coloring inorganics oxides, lead, cadmium, selenium, cobalt).
- Alkaline washer fluids to clean aluminum cookware.

In July 1974, NPDES Permit No. C-3094BD was issued for the facility. As the 1970's progressed, the facility discontinued the manufacturing of aluminum and porcelain cookware and use of the lagoon ceased in 1977. By the end of 1978, all copper-coating operations had ended and the principal products manufactured at the facility became pressed and coated non-stick bakeware.

During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the Corrective Measures Study (CMS). This correction is based on more recent review of historical plant documents.

The surface impoundment was reactivated in 1980 under the existing NPDES permit, and received housing degreaser filter water until mid-1984. The surface impoundment was finally decommissioned in December 1985. In March 1984, when the plant applied for a renewal of their NPDES permit, analysis of on-site well water for volatile organic compounds (VOCs) was required. The analysis indicated the presence of 1,1,1-TCA and TCE. This discovery resulted in subsequent investigations at the facility. The waste stream was diverted from the surface impoundment to

discharge in Newman Creek in December 1985. At that time, the surface impoundment (lagoon) was permanently taken out of service.

In 1992, the facility reported a 330-gallon 1,1,1-TCA spill northwest of the plant building and removed 50 tons of soil from the spill area. During 1993 and 1994, Roy F. Weston, Inc. (WESTON®) was retained by AHP to pursue a clean closure for the lagoon. Closure activities were conducted at the site from August 1993 to June 1994. A closure certification report was submitted to the OEPA in July 1994, and approval of the lagoon closure was issued in January 1995. Now that the lagoon is officially closed, quarterly groundwater sampling of the lagoon wells is no longer required for the RCRA lagoon closure.

WKI (formerly EKCO) continues to manufacture pressed and coated non-stick bakeware at the Massillon facility. A silicon-based compound is presently used to coat the bakeware to create the non-stick surface. A detailed description of the historical environmental investigations and a table summarizing the facility history are provided in the Community Relations Plan (Consent Order Reports and Plans, Vol. 1).

1.4.1 1984-1987 Investigations

Floyd Brown and Associates, Inc. (FBA) conducted the initial environmental investigations at the facility between 1984 and 1987. WESTON has conducted all subsequent environmental investigations at the facility since 1987.

Due to the discovery of 1,1,1-TCA and TCE in the groundwater production wells, the facility initiated an environmental investigation in 1984. Seven test borings were drilled into the shallow overburden and the underlying bedrock. Soil and water samples were collected from all seven locations and analysis of these samples indicated the presence of VOCs in both media. Subsequently, a pump and treat program using production wells W-1 and W-10 was implemented in 1986 to control migration of VOCs and remediate the groundwater by treatment in an air stripper.

1.4.1.1 1987 to Present Soil Investigations

This section provides a summary of soil investigations conducted by WESTON at the facility. Further detail on the September 2000 soil investigation can be found in the *Soil Investigation Report* (WESTON, February 2001).

WESTON conducted soil investigations at the facility in November 1988 and September 1991 during the RCRA Facility Investigation (RFI), and more recently in September 2000. During the November 1988 investigation, soil samples were collected from 14 locations at depths between 2 and 12 feet below ground surface (ft bgs). During the September 1991 investigation, soil samples were collected from 11 locations at depths from ground surface to 12 ft bgs. The locations of the soil borings are shown in Figure 1-4. It was found that the primary compounds detected in the soils included 1,1,1-TCA and TCE and their breakdown products, 1,1-dichloroethylene (1,1-DCE) and *cis*-1,2-dichloroethylene (1,2-DCE). A summary of the 1,1,1-TCA, TCE, 1,1-DCE, and 1,2-DCE analytical results for the November 1988 and September 1991 investigations is provided in Figures A-1 through A-4 in Appendix A. Based on these analytical results, the location of areas recommended for soil remediation included (as shown on Figure 1-1):

- The tank area in the southwestern portion of the plant – Area 1.
- The tank area at the western area of the plant – Area 2.
- The tank area at the northern end of the plant – Area 3.
- The northern end of the plant in the vicinity of production well W-10 – Area 4.

In September 2000, an additional soil sampling program was completed at the facility. Since it was 9 years after the completion of the previous November 1991 sampling program, this program was conducted to both confirm and further delineate VOCs in the proposed remediation areas. Soil borings were completed at 19 locations as shown in Figure 1-4. Soil samples were collected from ground surface to approximately 20 ft bgs and analyzed for VOCs. Again, it was found that that the primary compounds detected in the soils included 1,1,1-TCA, TCE, 1,1-DCE, and 1,2-DCE. A summary of the analytical results for the September 2000 investigation is provided in Figures A-5 through A-8 and Tables A-1 through A-4 in Appendix A. The following are the conclusions from the September 2000 soil sampling program:

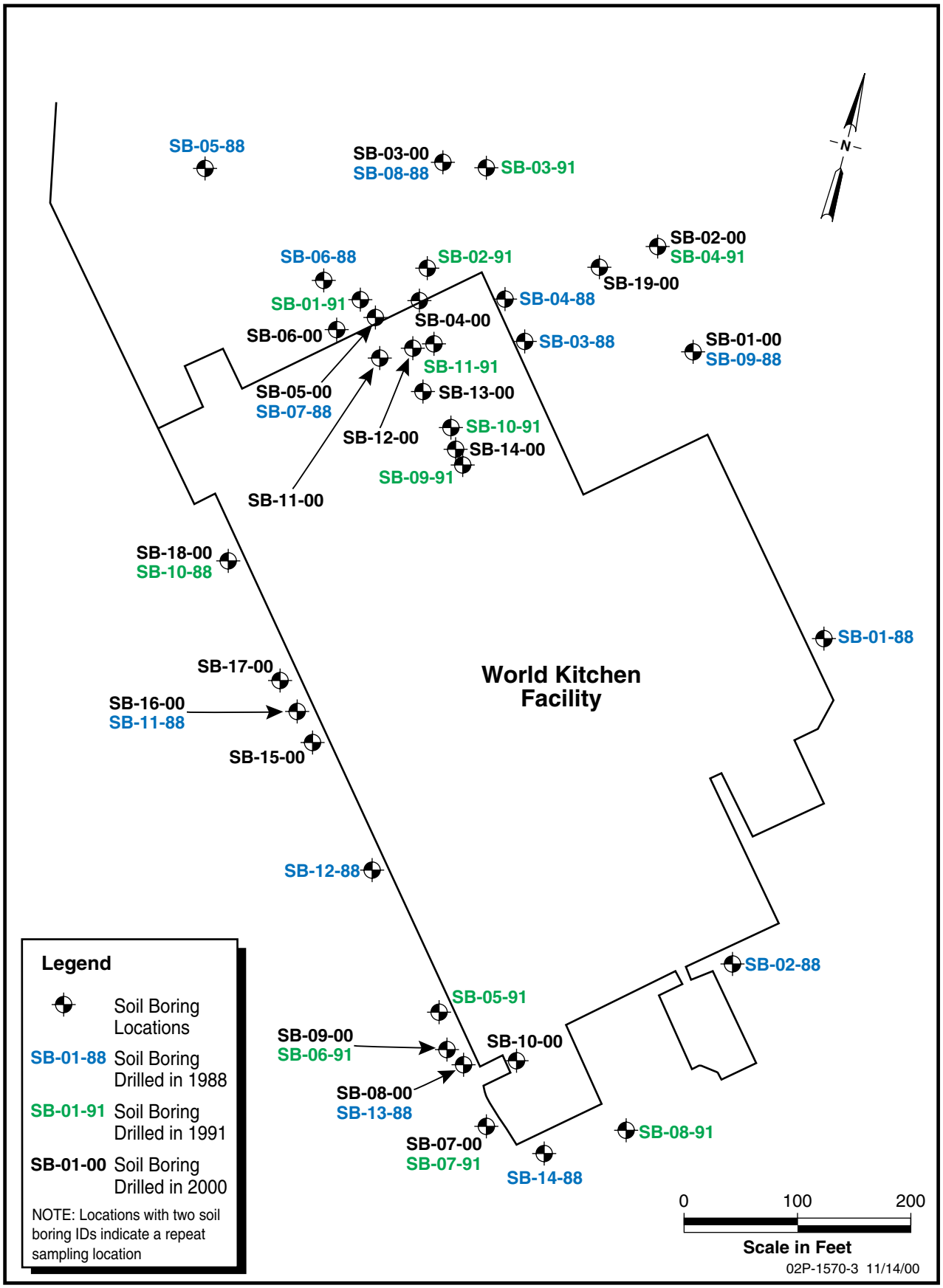


FIGURE 1-4 1988, 1991, AND 2000 SOIL BORING LOCATIONS

- Soil VOC concentrations were below the target cleanup levels (see Section 3 for discussion of target cleanup levels) in the area north of the plant – Area 3. Therefore, soil remediation was no longer needed in this area.

- In Area 4, VOC soil concentrations were greater than previously detected and exceeded target cleanup levels for 1,1,1-TCA, TCE, 1,2-DCE, and 1,1-DCE. The detection of higher VOC soil concentrations is most likely due to implementation of a new sampling method (SW-846 Method 5035) during this program.

- Soil concentrations of VOCs along the west side of the plant building (Area 2) and the southwest corner (Area 1) were generally in the same order of magnitude as previously detected. Area 1 soil concentrations exceeded target cleanup levels for 1,1,1-TCA, TCE, and 1,2-DCE. Area 2 soil concentration exceeded the target cleanup level for TCE.

- Soil TCE and 1,1,1-TCA concentrations at SB-01-00 and SB-02-00, located approximately 150 feet east of the northeast corner of the plant building, were greater than previously detected in this area. The soil TCE concentrations significantly exceeded the target TCE cleanup level at SB-02-00 to a depth of 7 ft bgs (the bottom of the boring), while at SB-01-00 only a slight exceedance occurred in the surficial layer (0 to 2 ft bgs). The source of the detected VOCs is unknown. This area is now designated as Area 3 – East (see Figure 1-1).

1.4.1.2 1987 to Present Groundwater Investigations

In 1987, WESTON conducted an interim measures assessment to collect baseline information and to determine the need for interim corrective measures. WESTON collected groundwater samples to establish baseline data for each well. The locations of site monitor wells are shown on Figure 1-3.

VOCs were detected in the on-site overburden and bedrock groundwater monitor wells. The primary compounds detected were TCE, 1,1,1-TCA and their breakdown products. The results of the initial investigation are presented in the *Interim Measures Report* (WESTON, February 1988).

WESTON conducted groundwater sampling in December 1988, September 1991, and March 1992. In addition to these three sampling events, selected wells were sampled quarterly from 1989 to 1995 as part of a lagoon closure plan for the site. Groundwater samples have been collected from site monitor wells on a semiannual basis since 1995. On-site well data are summarized in Table 1-1.

TABLE 1-1

GROUNDWATER SAMPLING RESULTS
WORLD KITCHEN MASSILLON, OHIO, FACILITY

Well ID	Approx. Times Sampled	Date[1] Sampled	Concentration[2] (µg/L)				Well Construction			
			TCE (5)	VC (2)	TCA (200)	1,1-DCE (7)	Diam. (in)	TD (ft)	DTW (ft)	Screened/ Open hole
Shallow Overburden Groundwater										
L-1	24	2/95	**59**	**15**	3	**25**	4	41	24.7	S
L-3	24	2/95	ND	ND	ND	ND	4	19	15.4	S
L-5	30	2/02	ND	**28**	ND	ND	4	24	7.5	S
S-4	3	3/92	5	ND	ND	ND	4	24	12.5	S
I-2	3	3/92	**490**	**29**	27	**70**	4	40	35.0	S
I-4	3	3/92	2	ND	ND	ND	4	73	21.8	S
I-5	3	3/92	1	ND	ND	ND	4	65	33.9	S
Bedrock Groundwater										
R-1	30	2/95	ND	ND	12	ND	2	120	63.4	S
R-2	60	8/02	**19**	1.9	ND	6.5	2	120	64.4	S
R-3	60	8/02	**38**	0.78 J	6.9	5.3	2	120	60.6	S
R-4	60	8/02	ND	1.4	ND	ND	6	175	22.3	O
R-5	30	8/02	**16**	**31**	ND	0.66	6	55	31.8	O
W-1	>200	9/02	**34**	ND	21	ND	13	~225	65	O
W-10	>200	9/02	**90**	ND	**280**	ND	10	~225	96	O

[1]Most recent sampling event and associated analytical results.
[2] Consent Order groundwater cleanup levels are shown in parentheses for each contaminant, and concentrations that exceed the cleanup level are shown in bold.
ND - Not Detected

Groundwater in all water-bearing zones beneath the facility is contained on-site and flowing toward production wells W-1 and W-10. VOCs in the groundwater at the site are being recovered by the site production wells and are being treated by the on-site air stripper system.

1.5 SUMMARY OF SITE CHARACTERISTICS

This section presents a summary of the site geology and hydrogeology. The site characteristics are fully discussed in the *RCRA Facility Investigation (RFI) Report* (WESTON, 1993) and the *Corrective Measures Study* (WESTON, 1993).

1.5.1 Geology

The facility is situated on the western flank of a glacial valley that extends to the north and south and was carved from Pennsylvanian age sedimentary rocks during the Pleistocene glaciation. Prior to the construction of the facility in 1945, a cover of fill material was used to level the natural glacially-formed topography at the building site. Beneath the fill, the glacially deposited sediments form a thin veneer 15 to 20 feet thick in the western portion of the site where bedrock is shallow. The sediments infill the glacial valley to the east, reaching a maximum thickness of approximately 110 feet at the eastern side of the property boundary.

Based on the vertical distribution of the geology encountered during drilling, layers of material were identified and correlated between monitor wells at the site. As shown in Figure 1-5, some relatively higher permeability sand and gravel units were identified, which are separated by relatively lower permeability silt and clay units. Underlying the glacial sediments, bedrock is encountered at its highest elevation in the northwestern portion of the site and slopes to the east at an approximate 17° angle. Bedrock encountered at the site consists of interbedded layers of sandstone, argillaceous sandstone, and shale. The shallowest bedrock unit encountered consists of an interbedded low permeable shale and argillaceous sandstone, which is underlain by a highly permeable, well sorted sandstone. The sandstone unit is the primary bedrock water-bearing unit at the site. Below the sandstone is another low permeable interbedded shale and argillaceous sandstone unit, which is directly underlain by shale.

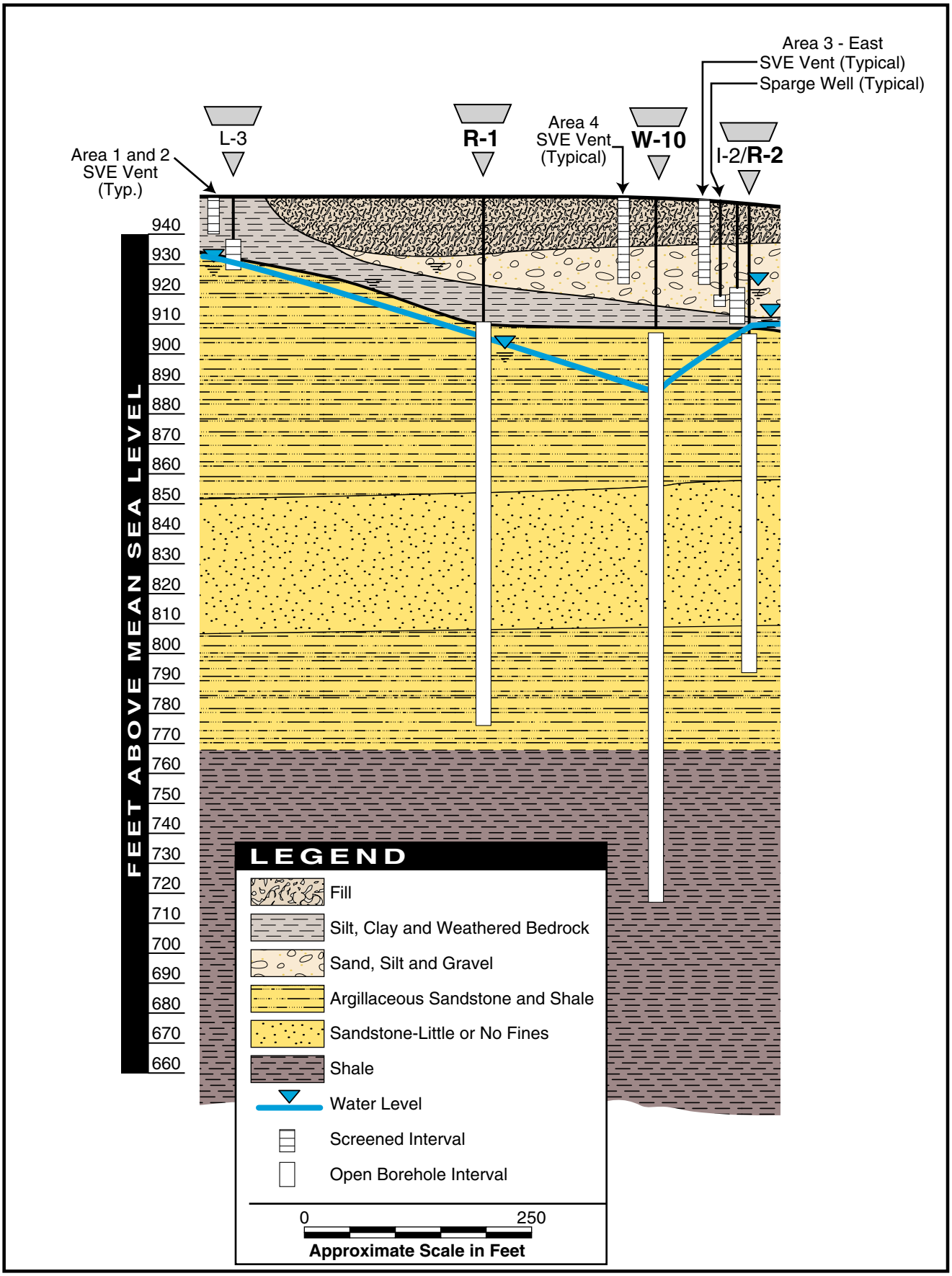


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FIGURE 1-5 SITE GEOLOGY AND REMEDIATION WELL SCHEMATIC WORLD KITCHEN, INC. (WKI) MASSILLON, OHIO FACILITY

1.5.2 Hydrogeology

Groundwater contour maps for the site indicate that the pumping of production wells W-1 and W-10 appreciably affects the groundwater flow in the shallow overburden and the bedrock water-bearing zones, creating a drawdown cone around wells W-1 and W-10. As a result of the pumping, the groundwater in the water-bearing zones under the entire site is flowing directly toward production wells W-1 and W-10. Groundwater contour maps for shallow overburden and bedrock groundwater were developed using November 2002 water level data and are presented in Figures 1-6 and 1-7.

1.6 CURRENT GROUNDWATER REMEDIATION SYSTEM

There are currently two on-site wells, W-1 and W-10, being used as both recovery wells and as production wells for use in manufacturing processes at the facility. One additional well, W-2, was previously used for groundwater production at the facility but was permanently taken out of service. Groundwater from production wells W-1 and W-10 is treated in an on-site air stripper, then either routed to various plant processes or discharged to Newman Creek via an underground storm sewer.

In March 1994, Interim Remedial Measures (IRM) activities were conducted at the site which included rehabilitation of wells W-1, W-2, and W-10 (WESTON, 1994). Geophysical logging conducted during these IRM activities provided additional construction and geologic information for these wells. The current construction of well W-1 consists of an open-hole well with steel casing to a depth of 28 feet and a PVC liner to a depth of 49 feet. The geophysical logging indicated that the well is currently open to a depth of 205 feet.

The current construction of well W-10 consists of an open-hole well with steel casing to a depth of 44 feet and a PVC liner to a depth of 45 feet. The geophysical logging indicated that the well is currently open to a depth of 159 feet.

During the IRM activities, well W-2 was also retrofitted with a PVC liner. The current construction of well W-2 consists of an open-hole well with steel casing to a depth of 90 feet and a PVC liner to a depth of 99 feet. The geophysical logging indicated that the well is currently open to a depth of 204 feet.

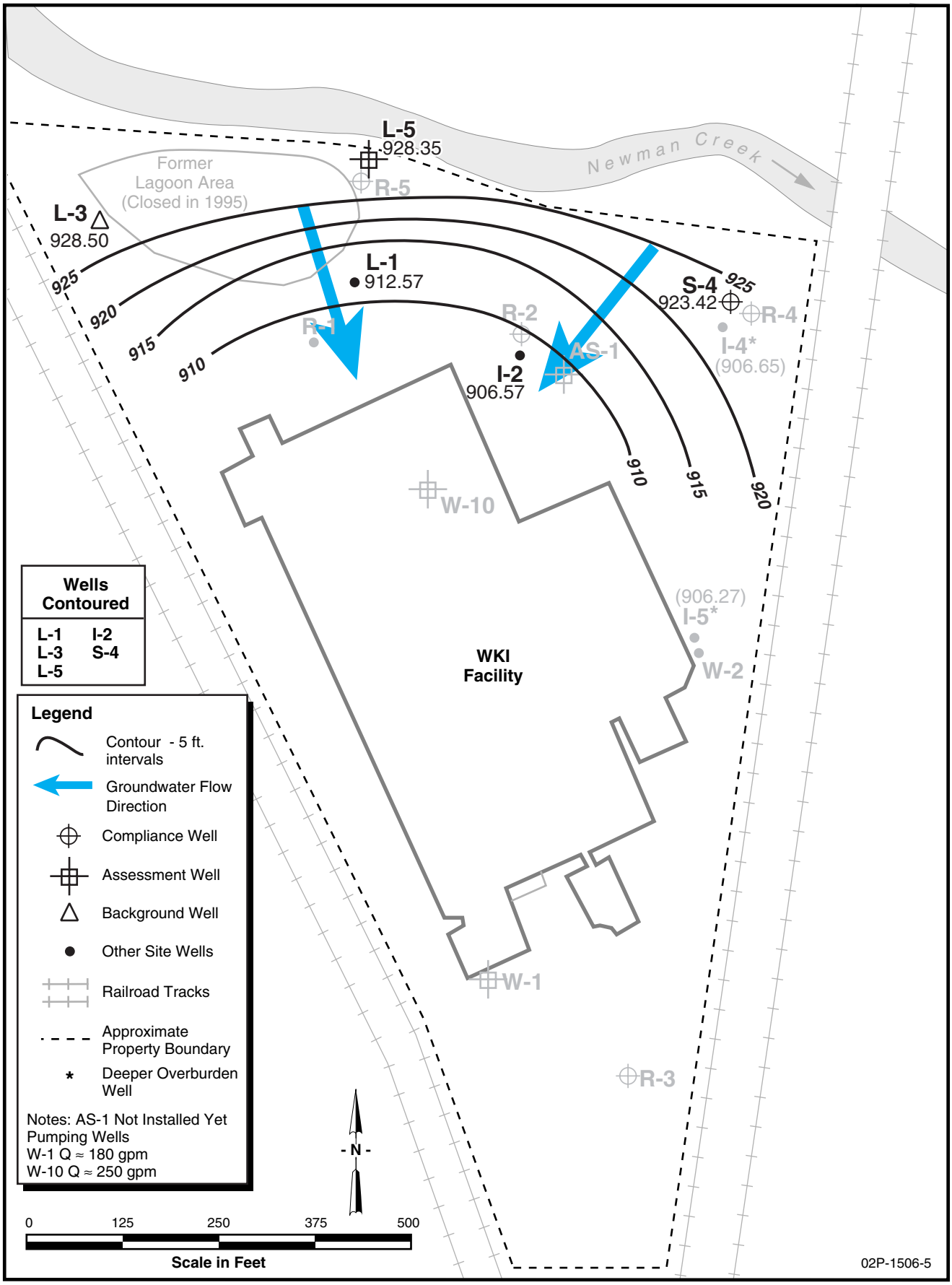

FIGURE 1-6 SHALLOW OVERBURDEN GROUNDWATER CONTOUR MAP WORLD KITCHEN, INC. (WKI) - MASSILLON, OHIO PROJECT WATER LEVELS MEASURED 5 NOVEMBER 2002

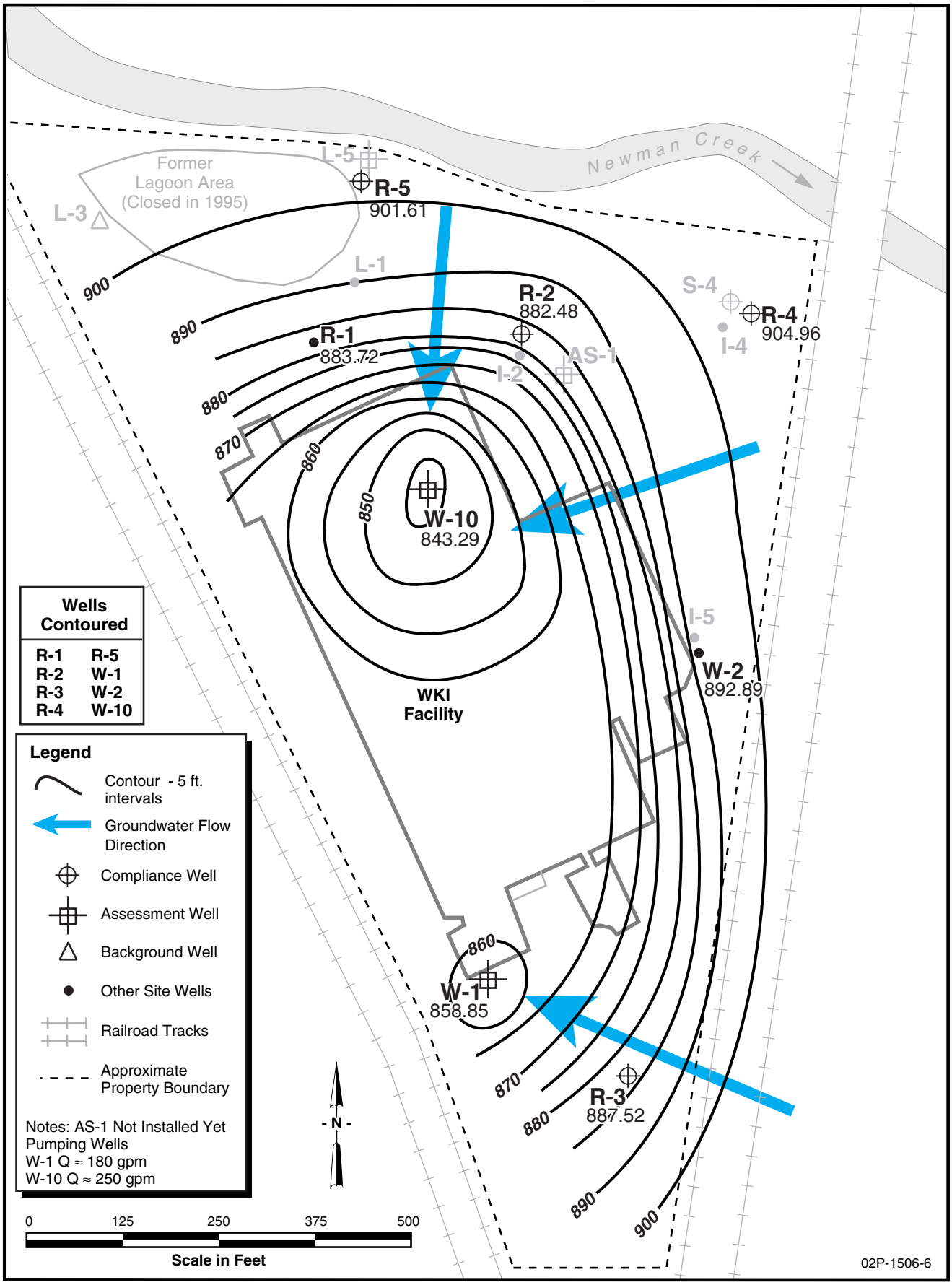

FIGURE 1-7 BEDROCK GROUNDWATER CONTOUR MAP
WORLD KITCHEN, INC. (WKI) - MASSILLON, OHIO PROJECT
WATER LEVELS MEASURED 5 NOVEMBER 2002

As with all of the bedrock wells on-site, production wells W-1 and W-10 produce the majority of their groundwater from the major sandstone unit, which exists beneath the site between the elevations of approximately 790 and 850 feet mean sea level (MSL). This sandstone unit, while productive, was dynamited across its length in wells W-1, W-2, and W-10 to maximize the yield of these wells at the time of installation.

The measured pumping rates and total VOCs detected for recovery wells W-1 and W-10 for the period 1990 through December 2001 are shown in Table A-5 in Appendix A. During this time period, the pumping rates at W-1 ranged from 145 to 300 gpm. The groundwater VOC concentrations ranged from 57 to 611 μg/L, with the exception of one total VOC detection at 4,726 μg/L after a 1-month downtime for the pump in W-1 (February 1992). More recently, in 2001, the pumping rate from well W-1 has ranged from 175 to 240 gpm, with total VOC concentrations in the 50 to 100 μg/L range.

During the period 1990 through 2001, the pumping rates at W-10 ranged from 235 to 405 gpm. The groundwater total VOC concentrations ranged from 666 to 3,928 μg/L. The maximum total VOC concentration of 3,928 μg/L occurred after a 1-month downtime for the pump in W-1 (February 1992). More recently, in 2001, the pumping rate from well W-10 has ranged from 230 to 295 gpm, with total VOC concentrations in the 750 to 1000 μg/L range.

The pumping rates have remained relatively consistent during the past 10 years, with the exception of occasional down times during well maintenance. Groundwater contour maps of the shallow overburden and bedrock water-bearing units indicate that the groundwater in these units is flowing toward the production wells, W-1 and W-10. Because the groundwater at the facility in these units is flowing toward the production wells, W-1 and W-10, VOCs in the groundwater at the facility are being captured by the site production wells and treated by the on-site air stripper system.

The results of the RFI indicate that no VOC-contaminated groundwater is migrating off-site. Therefore, users of groundwater supplies off-site in the area are not receptors, either actual or potential, for the migration of contaminated groundwater. Results of surface water and sediment samples collected from Newman Creek during the Groundwater Quality Assessments indicate

that the discharge of treated groundwater to Newman Creek had not resulted in an adverse environmental impact to the creek.

2. REMEDIATION OBJECTIVES

Recommended site-specific soil cleanup goals originally were presented in the CMS (WESTON, 1993). However, at the request of the U.S. EPA Region 5, these cleanup goals were recalculated using the more recent *EPA Soil Screening Guidance* (U.S. EPA, 1996) and submitted to the U.S. EPA in September 2000. The recalculated goals correspond to the soil cleanup levels presented in the Consent Order and in Subsection 2.1 below. However, Wyeth does not waive its right to contest the applicability of these levels to the site at a later date.

The groundwater cleanup levels correspond to the federal and state maximum contaminant levels (MCLs) for drinking water. For 1,1-DCA, which does not have an MCL, the U.S. EPA provided the cleanup level of 810 µg/L in a letter to Wyeth dated 16 July 2001.

The groundwater cleanup levels, which consist of MCLs and one site-specific cleanup level for 1,1-DCA, are presented in the Consent Order and in Subsection 2.2 below. However, Wyeth does not waive its right to contest the applicability of these levels to the site at a later date.

2.1 SOIL VAPOR EXTRACTION SYSTEMS

The remediation objectives for the SVE systems in Areas 1, 2, 3-East, and 4 per Figure 1-1 are:

- To remove VOCs from the soils in the treatment areas and to achieve the soil cleanup levels specified in accordance with the Consent Order Scope of Work. The specified soil cleanup levels are listed below:

VOC	*Soil Cleanup Level*
1,1-dichloroethylene (1,1-DCE)	120 µg/kg
1,2-dichloroethylene (1,2-DCE) (total)	1,500 µg/kg
1,1,1-trichloroethane (1,1,1-TCA)	6,140 µg/kg
trichloroethylene (TCE)	230 µg/kg

2.2 AIR SPARGE SYSTEM

The remediation objective for the air sparge system is to remove VOCs from the shallow groundwater in the Area 3-East SVE treatment area and to achieve the groundwater cleanup

levels in accordance with the Consent Order Scope of Work in the proposed air sparging assessment well AS-1. The specified groundwater cleanup levels are listed below:

VOC	*Groundwater Cleanup Level*
1,1-dichloroethane (1,1-DCA)	810 µg/L
1,1-dichloroethylene (1,1-DCE)	7 µg/L
cis-1,2-dichloroethylene (*cis*-1,2-DCE)	70 µg/L
trans-1,2-dichloroethylene (*trans*-1,2-DCE)	100 µg/L
1,1,1-trichloroethane (1,1,1-TCA)	200 µg/L
trichloroethylene (TCE)	5 µg/L
vinyl chloride (VC)	2 µg/L

2.3 PULSE PUMPING SYSTEM

The remediation objectives for the groundwater extraction system at wells W-1 and W-10 are:

- To remove groundwater containing VOCs from the shallow overburden and bedrock groundwater beneath the site and to achieve the groundwater cleanup levels listed in Section 2.2 in accordance with the Consent Order Scope of Work groundwater monitoring program.
- To maintain an inward groundwater flow gradient toward wells W-1 and W-10 in the shallow overburden and bedrock groundwater zones beneath the site, as specified in Paragraph 20 of the Consent Order.

3. DESIGN BASIS

3.1 SITE CONCEPTUAL MODEL

Based on the site stratigraphic, hydrogeologic, and analytical data, a conceptual model has been developed to understand the movement and distribution of VOCs in soil and groundwater at the facility. The primary components of the conceptual site model are discussed below. More detailed information on site conditions is included in the *2001 Groundwater Monitoring Report* (WESTON, 2002) and the RFI (WESTON, 1993) and CMS (WESTON, 1993) reports.

The VOCs, primarily TCE, 1,1,1-TCA, and their breakdown products, that have been detected in soil and groundwater at the facility, originated from past chlorinated solvent use for degreasing and cleaning during manufacturing activities. TCE and 1,1,1-TCA were used at the facility for cleaning and degreasing activities. Their use was discontinued in 1994, when they were replaced with a Borax aqueous cleaner, which is still used at the facility.

Areas where VOCs exist in the soil and groundwater beneath the facility include: inside the plant building near well W-10 (Area 4), outside the building along the western wall (Areas 1 and 2), and east of the northeastern corner of the plant building (Area 3-East). The potential movement of VOCs in the subsurface in these areas is discussed below:

Area 4 – Near Well W-10

- During the time period of 1973, a significant overflow of degreaser solvent occurred in the area of well W-10. The overflow was described as inches of chlorinated solvent on the floor in the area of the spill. The 1973 solvent overflow date is a correction of the 1979-1980 estimated solvent spill date reported in the CMS. This correction is based on more recent review of historical plant documents.

- Being in liquid form, the degreaser solvent would have spread out on the concrete floor and moved by gravity through any cracks or openings in the floor. At the time of the spill, well W-10 was located in a vault which was covered with a metal traffic grate on the floor surface. The degreaser solvent could have moved downward into the vault and then migrated into the subsurface around well W-10. Solvent that seeped through cracks or openings in the plant floor other than at the well W-10 vault could have moved downward into the overburden.

Areas 1 and 2 – Along the Western Property Boundary

- There was one reported 1,1,1-TCA release in 1992 in the vicinity of Area 2 outside the northwest wall of Building 1. Fifty tons of soil were removed from the spill area. The 2000 soil boring program results for this area indicated no 1,1,1-TCA concentrations in soil at greater than its soil cleanup level.

- Historically, there were a number of activities along the western wall of the facility that could have contributed to incidental releases of solvents to the ground. For Area 1, this includes the former TCE aboveground storage tank (AST) and the former solvent blend underground storage tank (UST) outside the southwest corner of the building and the mixing room just inside this corner of the building. For Area 2, this includes the degreasing units immediately inside and along the western wall, the mixing room, and the former solvent blend UST. It is important to note that both USTs along the western wall were leak-tested in 1991 and passed, and the USTs have since been removed.

- In Areas 1 and 2, an incidental release of solvent to the ground would have resulted in some of the solvent being adsorbed into the shallow overburden soils. The overburden in this area is approximately 10 feet thick and bedrock is shallow.

Area 3–East – East of the Northeast Corner of Building 5

- Near boring SB-02-00, soil data indicate the presence of VOCs, primarily TCE and 1,1,1-TCA. There are no documented spills or releases in this area and the source of the VOCs detected in this area of the facility is unknown.

- An incidental release of solvent to the ground would have resulted in some of the solvent being adsorbed into the overburden soils. Based on the available data, the overburden in this area is approximately 40 feet thick, and groundwater occurs around 30 ft bgs. Over time, rainwater infiltration into the soils would result in some desorption of VOCs into the water and downward migration into the shallow groundwater. Also, some volatilization of the VOCs from the near surface soils would occur.

The groundwater extraction system maintains an inward groundwater gradient toward pumping wells W-1 and W-10 in all groundwater beneath the facility. Matrix diffusion, desorption, and dissolution of VOC constituents in the three hydrogeologic units are the principal source of dissolved phase VOCs detected in groundwater from the site wells. The inward groundwater gradient ensures that contaminated groundwater is contained and recovered for treatment in the air stripper.

3.2 DESCRIPTION OF THE REMEDIATION SYSTEM AND OPERATION

The corrective measures that will be implemented to address the presence of VOCs in soil and groundwater at the facility include: soil vapor extraction in Areas 1, 2, 3-East, and 4, air sparging of shallow groundwater in Area 3-East, and recovery of site groundwater at pumping wells W-1 and W-10 for treatment in an air stripper. SVE will be implemented in areas where vadose (unsaturated zone) soils exhibit target compound concentrations greater than the soil cleanup objectives (presented in Section 2). SVE is a proven technology, which removes VOCs from soil by mechanically drawing air through the soil pore spaces. It is most successful in moderate to higher permeability soils where air can be readily drawn through soil pore spaces, but can be designed to address conditions where some lower permeability lenses or layers occur. As the air moves through the soil, VOCs volatilize into the subsurface air. A suction blower is used to create a negative pressure (vacuum) in a series of extraction vents that have been installed in an impacted area. This negative pressure causes air to be drawn from the subsurface unsaturated zone soil. The VOC-laden air stream is then collected and directly discharged to the atmosphere or treated prior to discharge, depending on the types and amounts of organic compounds in the air stream.

For application at the facility, Areas 1 and 2 vents will be connected to a single blower. Areas 3-East and Area 4 each will be connected to a blower, such that there will be three total SVE blower systems. The blowers will operate continuously except for occasional maintenance activities.

Air sparging will also be implemented at Area 3-East in conjunction with SVE to address shallow groundwater contamination beneath the Area 3-East SVE area. It was originally proposed in the CMS for implementation in Area 3 at the northeastern corner of the plant building. However, results from the 2000 soil boring program showed that the soils from this area no longer exceeded the soil cleanup levels and do not require treatment. In accordance with the Consent Order Scope of Work, the original Area-3 soil treatment area was moved to Area 3-East where soils were found to exceed cleanup levels in the 2000 soil boring program. The air sparging and SVE system in Area 3-East will coincide so that sparged air can be collected by the SVE system.

Air sparging, also known as in situ air stripping, is a proven technology for treating groundwater containing VOCs. Air is injected by a blower into a series of groundwater well points. The sparge blower will operate continuously except for maintenance downtimes. VOCs dissolved in the groundwater will volatilize into the air as the air bubbles move through the impacted groundwater. When air sparging is combined with SVE, the SVE system collects the vapor-phase VOCs as they migrate upward through the vadose zone soil pore spaces.

The groundwater extraction system operates with both wells (W-1 and W-10) pumping at the same time. The pumping rate for each well currently varies from approximately 175 and 225 gpm in well W-1 and 225 to 275 gpm in well W-10, depending on fluctuating aquifer water levels and pump performance. Recovered groundwater is treated in an existing air stripper prior to use in plant production processes or discharged to Newman Creek north of the plant. During the implementation of the remedial measures, the pumps will be pulsed periodically. That is, on a periodic basis, one pump will be shut down for a short time, allowing the water table to rise an incremental amount. By doing so, some VOCs in the now unsaturated geologic matrix within the drawdown zone of the pumping well will be flushed as the groundwater levels recover. This flushing may desorb and dissolve VOCs from the bedrock fractures into the groundwater. It is important to note that the second well pump will remain in service and will maintain an inward groundwater gradient while the first pump is not in operation. This pulse pumping will alternate shutdown intervals between the pumps in wells W-1 and W-10 and is expected to improve VOC removal rates. The Operation and Maintenance Plan (COPR, Vol. 4) will describe the scheduled maintenance activities that will be conducted to minimize maintenance problems and uncontrolled system downtime. To the extent possible, the pulse pumping shutdown schedule will coincide with the scheduled pump and well maintenance activities. The facility water needs will also be considered when scheduling the brief shutdown periods.

3.3 DESIGN CRITERIA/PERFORMANCE REQUIREMENTS

The design of the SVE/air sparge/pulse pumping remediation systems for the facility incorporated the following considerations with respect to site conditions and performance requirements:

- The SVE/air sparge systems will operate continuously except for periodic maintenance activities.

- The SVE systems are designed to treat the overburden vadose zone soils in each of the four areas, which are depicted in Figure 1-1 and as presented in the Consent Order Scope of Work. In Areas 1 and 2, the overburden is approximately 10 feet thick and is unsaturated. In Area 3-East, the overburden is approximately 40 feet thick and groundwater is encountered at depths ranging from 22 to 35 ft bgs. In Area 4, the overburden is approximately 11 to 20 feet thick and is unsaturated. As such, the target SVE treatment zone extends to a depth below ground surface of approximately 10 feet in Areas 1 and 2 and 20 feet in Areas 3-East and 4. Blowers are sized to achieve sufficient system vacuum (a minimum of 6 to 8 inches of mercury (in Hg)) and flow rates (approximately 2 scfm/foot screen/vent).

- Emissions from the SVE systems must be controlled if they exceed de minimis values as specified by OEPA.

- The air sparge system is designed to treat the shallow groundwater beneath Area 3-East. The blower is sized to achieve approximately 3 to 7 scfm injected per well with 10 to 15 feet of water column. Sparged air will be collected by the SVE system at Area 3-East.

- The pumping system must maintain an inward groundwater gradient towards wells W-1 and W-10. All recovered groundwater must be treated in the air stripper prior to use in plant processes or discharge to Newman Creek.

3.4 SYSTEM COMPONENTS

The following sections provide the basis for the SVE and air sparge system design and the important features of system equipment. The manufacturer's specifications for the major equipment items are provided in Appendix B and the design drawings are provided in Appendix C. Drawing No. 100 shows the plant layout and is the plant base map used for the design. Drawing Nos. 101 through 105 present design details.

3.4.1 SVE Vent Construction and Placement

Continuous split-spoon samples were collected from 44 soil borings completed in 1988, 1991, and 2000. These data were used to design the SVE system. The SVE vents will be installed using hollow-stem auger drilling techniques and the borehole cuttings will be logged to provide general soil profile data. Additional split-spoon samples may also be collected, as needed, during the SVE vent installation if unexpected conditions are observed in the cuttings. The depths and screened lengths of the vents may be adjusted based on the soil profiles encountered.

The relative permeability and texture of the soil, as they relate to the design parameter called the radius of influence (ROI), affects the number and location of the extraction vents in a SVE system. The ROI is defined as the maximum distance from the extraction vent at which subsurface air flow, as measured by pressure gradient toward the vent, is observed. This implies that all the soils within this ROI will be subject to treatment. The ROI is a site-specific design parameter as it is dependent on the type of soils and soil profile found at a given site. There is no site-specific measurements of air permeability of the vadose zone for the facility. However, based on WESTON's past experience at sites with similar soil texture, the ROI should be in the range of 15 to 30 feet. For the purpose of this system design, the vents in the primary treatment areas were conservatively spaced with a 15-foot ROI, and outside the primary treatment area, the distances were slightly greater. The primary treatment areas correspond to Areas 1, 2, 3-East, and 4 shown on Figure 1-1 and specified in the Consent Order Scope of Work, where significant exceedance of the soil cleanup levels were detected. The SVE system and vents were extended beyond the primary treatment areas to provide additional treatment for less impacted soils that only slightly exceed cleanup levels and/or adjacent areas (which could be impacted) where no data are available. The SVE vent design and placement for each the four treatment areas is discussed in more detail below.

Area 1 – The Area 1 SVE system layout is shown in Drawing 102. Inside and outside the southwest corner of the WKI building, soil samples were previously collected at seven boring locations as shown in Figure 1-4. The analytical results for samples collected more recently at SB-08-00 and SB-09-00 confirmed previous results indicating TCE concentrations exceeding the soil cleanup level down to 10 ft bgs, where bedrock was encountered. Additionally, the results for SB-09-00 indicated that 1,2-DCE was detected at a concentration exceeding the cleanup level. Inside the building in this area, 1,1,1-TCA was detected at a concentration slightly greater than its cleanup level at soil boring location SB-10-00. Soil borings SB-05-91, SB-07-00, SB-14-88, and SB-08-91 did not indicate an exceedance of soil cleanup levels and thus provide an outer limit to the treatment area.

Based on these analytical data and the physical features of the site, three SVE vents have been laid out in Area 1 at the locations shown on Drawing 102. The primary treatment area is shown conservatively based on a 15-foot ROI. Soil borings SB-08-00 and SB-09-00 are encompassed

by the primary treatment area of these vents. The SB-10-00 location is inside the building and cannot be accessed. However, it is expected that the influence of the SVE system will extend laterally under the building and into this area. As shown in Drawing 102, #1 vent will be located in the open alcove on the building's southwest corner to address the lower concentrations of VOCs occurring in soils from this area. The three vents will be constructed to a depth of 10 ft bgs or bedrock, whichever occurs first, with a 5-foot screened interval from 5 to 10 ft bgs through the vadose zone. The vent depths and construction requirements are depicted on Drawing 104. As shown on this drawing, each vent will consist of Schedule 40 PVC slotted pipe surrounded by pea gravel for the specified treatment (screened) interval and solid riser pipe to the ground surface. The pea gravel will extend from the vent bottom to above the top of the screen. From this point to the ground surface, the annulus will be filled with at least a 3-foot length of a cement bentonite grout. Each vent will have a flow regulating valve and a port for flow measurement and sampling. All vents will be connected to the suction side of the blower through an aboveground system of air collection laterals and manifolds. The laterals and manifolds will be 4-inch diameter PVC piping. The general piping layout is shown in Drawing 101.

Area 2 – The Area 2 SVE system layout is shown on Drawing 102. Soil samples were previously collected from five boring locations along the western wall of the facility as shown in Figure 1-4. Concentrations of TCE were greater than the soil cleanup level at locations SB-16-00 and SB-17-00 down to a depth of 7.5 ft bgs. Bedrock was encountered at 9 ft bgs. No exceedances were observed at soil boring location SB-15-00 just south of SB-16-00. To the north of SB-17-00, a slight exceedance of the TCE cleanup level was detected at 2.5 ft bgs in SB-18-00.

Based on the analytical data and the physical features of the site, seven SVE vents have been laid out in Area 2 at the locations shown on Drawing 102. The primary treatment area includes three vents (#1, 2, and 3), which encompass the SB-16-00 and SB-17-00 locations, and the secondary treatment area includes four vents (#4-7) and extends north along the building wall to include the SB-18-00 location. The seven vents will be constructed to a depth of 10 ft bgs or bedrock, whichever occurs first, with a screened interval from 5 to 10 ft bgs through the vadose zone. The vent depths and construction requirements are depicted on Drawing 104. The vent construction is

the same as in Area 1. Through an aboveground system of air collection laterals and manifolds, all vents will be connected to the suction side of the blower that will service Area 1 and Area 2. The laterals and manifolds will be 4-inch diameter PVC piping. The general SVE piping layout is shown in Drawing 101.

Area 3-East – The Area 3-East SVE/air sparging system layout is shown on Drawing 103. Soil samples were previously collected from five soil boring locations off the northeast corner of the facility as shown in Figure 1-4. The TCE soil cleanup level was exceeded at soil boring location SB-02-00 to a depth of 7 ft bgs and only slightly exceeded at soil boring location SB-01-00 at a shallow depth of 2.5 ft bgs. Soil borings SB-03-88, SB-04-88, and SB-19-00 did not indicate an exceedance of soil cleanup levels.

Based on the site data, the Area 3-East system will focus on the boring SB-02-00 area, which has more significant levels of VOCs. The SB-01-00 area is surficial and would not be effectively addressed by the SVE system. The low levels at this location can be addressed by natural weathering.

Area 3-East will contain seven SVE vents at the locations around boring SB-02-00, as shown on Drawing 103. The primary treatment area will be centrally located at one vent (#4) adjacent to the soil boring SB-02-00 location, with the remainder of the vents providing additional treatment in the surrounding area. The seven vents will be constructed to a depth of 20 ft bgs, with a screened interval from 5 to 20 ft bgs through the vadose zone. The vent depth was selected based on reviewing water level data for nearby well I-2 from 1988 to 2001. These data indicated that depth to groundwater ranged from 35.6 ft bgs to 22.9 ft bgs, with the shallowest recorded groundwater measurement in April 1994. The vent depths and construction requirements for Area 3-East are depicted on Drawing 104. The vent construction is the same as in Areas 1 and 2. Through an aboveground system of air collection laterals and manifolds, all vents will be connected to the suction side of the blower that will service Area 3 only. The laterals and manifolds will be 4-inch diameter PVC piping. The general SVE piping layout is shown in Drawing 101.

The groundwater sparging which will be part of the system for this area is discussed in Section 3.4.2.

Area 4 – The Area 4 SVE system layout is shown on Drawing 103. Area 4 is located within the plant building, and this area of the building is used for active storage and warehousing. Storage racks are aligned with aisleways for forklift access. The system which is installed in this area must be compatible with ongoing plant operations and not significantly interfere with use of this storage area.

Soil samples were previously collected from seven soil borings inside the northern area of the plant building as shown in Figure 1-4. The September 2000 analytical results indicated that TCE, 1,1-DCE, 1,2-DCE, and 1,1,1-TCA are present at concentrations greater than the soil cleanup levels to a depth of approximately 20 ft bgs. Soil borings SB-14-00, SB-13-00, SB-09-91, SB-10-91 and SB-11-91 were all drilled within a single aisle inside the building in the area of W-10 where the historical spill occurred. The highest concentrations of VOCs occurred in soil borings SB-14-00 and SB-13-00.

Soil boring SB-11-00 was drilled at the end of the aisle to the west and SB-12-00 was at the end of the aisle to the east. Samples from both of these soil borings indicated significantly lower VOC concentrations (but still exceeding cleanup levels) than detected in SB-14-00 and SB-13-00, which were located within the aisle.

North of Area 4 and outside the plant building, subsurface soil samples have been collected at nine locations, as shown in Figure 1-4. TCE concentrations were detected above cleanup levels at three boring locations sampled in 1988 (SB-06-88, SB-07-88, and SB-08-88). The soils at locations SB-07-88 and SB-08-88 were resampled at similar depths during the September 2000 investigation at locations SB-05-00 and SB-03-00, respectively. Additional soil samples were collected in this area during the September 2000 investigation at locations SB-04-00 and SB-06-00. The analytical results obtained from the soil samples collected at all four 2000 soil boring locations showed that TCE concentrations have decreased in this area since 1988 and are now below soil cleanup levels for Area 4.

Based on the site data and physical constraints, Area 4 will contain 13 SVE vents at the locations shown on Drawing 103. The primary treatment area will be centrally located at the six vents (vents # 1-6) located within the aisle also containing well W-10. The remainder of the vents will

provide additional treatment in the surrounding area and will be located in the aisles on both sides of the primary treatment area.

The 13 vents will be constructed to a depth of approximately 20 ft bgs or bedrock, whichever occurs first, with a screened interval from approximately 5 to 20 ft bgs. The depths and screened lengths of the vents may be adjusted based on the soil profiles encountered. The vent depths and construction requirements for Area 4 are depicted on Drawing 104. The vent construction is completely below floor as the vents will be located in an operational area of the facility with high traffic. A traffic cover will be placed over each vent and will be flush with the floor. The lateral piping will convey the extracted air from the individual vents to a header along the north wall of the building. The lateral piping will be placed in below slab trenches within the three aisles as shown in Drawing 104 and will be brought above floor level at the north wall to connect with the header. The laterals will be 4-inch diameter Schedule 40 PVC piping and the header will be 6-inch diameter Schedule 40 PVC piping to the blower. The header will be connected to the suction side of the blower that will service Area 4 only. The general SVE piping layout is shown in Drawing 101.

3.4.2 Sparge Well Construction and Placement

As required in the Consent Order, an air sparging system will be installed in Area 3-East to accelerate the reduction of VOCs in shallow groundwater from this area as it moves toward the facility's pumping wells. The layout of the shallow groundwater sparge system is shown in Drawing No. 103. It consists of a line of four sparge points that spans the SVE treatment area. As a result, sparged air will be collected by the SVE system. The system layout is oriented perpendicular to groundwater flow, which is depicted in Figures 1-6 and 1-7. The individual sparge points are spaced approximately 15 to 20 feet apart for a total length of approximately 60 feet between the endpoints. The sparging system will create an aeration zone for in situ stripping of VOCs from the shallow groundwater in this area.

The sparge wells will be installed using hollow-stem auger drilling techniques. During drilling activities, the borehole cuttings will be logged for physical characteristics. This will provide additional soil profile data that may impact air flow patterns when the air is injected.

The sparge well construction details are depicted on Drawing No. 104. The sparge points will extend to a depth of 5 to 15 feet below the water table for a total depth of approximately 40 ft bgs. This is based on reviewing water level data for nearby well I-2 from 1988 to 2001. The depth to groundwater over this time period ranges from 22.9 ft bgs to 35.6 ft bgs, which is the deepest recorded in August 2001. The depth and screened interval may be adjusted based on the soil profile and water table elevation encountered in Area 3-East. Each sparge well will be constructed of 1-inch diameter Schedule 40 PVC casing with 2 feet of screen at the base. A sand pack will be placed in the annulus around and above the screen. A bentonite seal, followed by cement bentonite grout, will extend from the sand pack to ground surface. The wellhead will contain a flow valve and air line so that each sparge point is joined to the blower manifold. The manifold will be connected to the discharge of a blower that services the sparge system only. The general piping layout is shown in Drawing No. 101.

3.4.3 Startup Operations

Startup procedures will be included in the Operation and Maintenance Plan for the SVE/Sparge/Pulse Pumping System at the WKI facility, which will be submitted to the U.S. EPA in the COPR, Volume 4, on or before November 2003. In general, once installation of SVE vents, sparge wells, and equipment is complete, each system will be "bump started" to check proper electrical connections and blower rotation. The system can then be started and run for mechanical checkout and leak testing. Any leaks that are found will be sealed.

After the mechanical checks and leak tests are completed, the systems will be started up. Operating parameters such as flow rate, pressure, and VOC concentrations will be measured at various points throughout the system. During the startup period, flows and pressure will be measured for flow balance among the individual vents and VOCs measured in the system with an organic vapor meter (OVM). Operating parameters will be measured and recorded for the duration of system operation to document operations. Sampling and monitoring will be conducted to track system performance and make operating adjustments.

3.4.4 Major Equipment

The following sections provide the specifications for the major equipment on the SVE, sparge, and pulse pumping systems. However, if necessary, equivalent units may be procured if specified units are not available, cost effective, or cannot meet delivery schedules. It is important to note that 460-volt (V)/3-phase power and 120V/single-phase power are available at the facility.

3.4.4.1 SVE Blower System

Positive displacement blowers will be used to provide the vacuum to extract air from the vents in Areas 1 through 4 and have been sized to accommodate 2 scfm/ft of screen/vent. During initial operation of the SVE systems, the concentrations of VOCs in the extracted air are expected to be higher, and thus require emission control. The control specified here is vapor phase activated carbon. Based on WESTON's experience, the VOC removal rates in the SVE system are expected to decrease with time in the form of an exponential decay function. As such, when removal approaches the latter stages of SVE operation or the flat portion of the VOC removal rate versus time plot and the VOC concentrations are less than de minimis values, the control may be removed, contingent on regulatory approval. The following are the specifications for the blowers and major equipment that will be used for each SVE:

Blowers

- Areas 1 and 2 (10 vents)
  Manufacturer: Tuthill Vacuum and Blower Systems
  Model No.: ACOUSTICAIR 4112-81L3
  Hp: 20 (15 BHP)
  Air Flow Rate: 240 scfm
  Inlet Vacuum: 9 in. Hg
  Power Requirement: 460V/3 phase

- Area 3 (7 vents)
  Manufacturer: Tuthill Vacuum and Blower Systems
  Model No.: ACOUSTICAIR 5607-81L3
  Hp: 30 (22 BHP)
  Air Flow Rate: 360 scfm
  Inlet Vacuum: 10 in. Hg
  Power Requirement: 460V/3 phase

- Area 4 (13 vents)
  Manufacturer: Tuthill Vacuum and Blower Systems
  Model No.: ACOUSTICAIR 5611-81L3
  Hp: 40 (35 BHP)
  Air Flow Rate: 540 scfm
  Inlet Vacuum: 11 in. Hg
  Power Requirement: 460V/3 phase

Heat Exchangers

A heat exchanger will be required to cool the air stream after it leaves the blower, prior to treatment in the carbon units.

Manufacturer: Xchanger, Inc.
Model No: AA-1000
Type: Air cooled, fan

Carbon Adsorption Units

Manufacturer: Calgon Carbon Corporation
Model No.: HFVS 1000, HFVS 3000
Air Flow Capacity: 1000 cfm, 3000 cfm
Maximum Inlet Temp.: 140°F

The manufacturer's specifications for the major equipment items are provided in Appendix B. It is important to note that there will be an inline filter to remove particulates prior to each blower as well as a knockdown drum to remove any entrained water in the system. Silencers will be placed on both the inlet and outlet to each blower. The blower and associated equipment will be placed in an enclosure. The general equipment layout is shown on Drawing 105. The carbon units will be placed outside the enclosure.

3.4.4.2 Sparge Blower System

A positive displacement blower will be used to inject approximately 5 scfm of air/sparge well in Area 3-East. The following are the specifications for the blower:

Manufacturer: Tuthill Vacuum and Blower Systems
Model No.: COMPETITOR PLUS 2002-21T2
Hp: 5 (3 BHP)
Air Flow Rate: 25 scfm
Discharge Pressure: 10 psi
Power Requirement: 460V/3 phase

A heat exchanger will be required to cool the air stream after it leaves the blower, prior to injection through air lines to the PVC sparge wells.

Manufacturer:	American Precision Industries
Model No:	761-03011H
Type:	Air cooled, fan

The manufacturer's specifications for the major equipment items are provided in Appendix B. The sparge blower and associated equipment will be placed in the same enclosure for the SVE blower and associated equipment in Area 3-East. The general equipment layout is shown on Drawing 105.

3.4.4.3 Pulse Pumps

The existing submersible groundwater pumps in production wells W-1 and W-10 will be operated to "pulse pump" the groundwater. A schedule will be developed to allow each pump to be turned off for a brief period of time so that the water table in the area of this production well can recover. The pump will be reactivated and the water table depressed. Groundwater will naturally move (i.e., flush) through the bedrock fractures. The initial pulsing schedule will be provided in the Operation and Maintenance Plan (COPR, Vol. 4) and will be determined and adjusted as needed based on several factors, including plant production and water needs, maintaining groundwater capture, rate of change in water levels from pulsing, and groundwater VOC concentrations.

4. WASTE MANAGEMENT

Drill cuttings will be generated during the construction of SVE vents and air sparge wells. The cuttings and soils generated from the installation of the SVE and sparge systems will be containerized in drums that are dated and labeled. A Toxicity Characteristic Leaching Procedure (TCLP) will be performed for characterization of the waste soils. The soil will be disposed according to regulatory requirements. Construction debris that is generated during installation of the system will be discarded with the plant's industrial debris/trash. Since there will be no significant disruption to the soils during construction, stormwater management is not necessary. However, the individual areas where vents and wells are installed will be graded to promote drainage away from these features.

5. PERMITTING AND APPROVALS

5.1 AIR SPARGE WELLS

The injection of air into the subsurface through a Class V well may require Permits to Install and/or Permits to Operate. Air sparge wells are considered Class V wells. The Ohio EPA Division of Drinking and Groundwaters (DDAGW) Underground Injection Control Unit (UIC) has regulatory authority for this issue.

For installation of the sparge wells, it is possible to apply and receive exemption from formal permitting procedures for Class V 5X26 Aquifer Remediation Projects. Rather than completing Class V Permit to Install (PTI) and Permit to Operate (PTO) applications, we will submit a copy of this design report which contains the information required by the DDAGW UIC such as:

- A description of the nature of the spill/release.
- A hydrogeologic site description.
- A detailed description of the proposed remediation action.
- An analysis of the fluids to be injected (in this case, just ambient air).
- The volume and rate of fluid to be injected.
- The results of groundwater monitoring.
- The name of the Ohio EPA staff member overseeing any related site activities.

A copy of the UIC permitting/approval submittal and subsequent correspondence will be provided to the U.S. EPA.

5.2 SVE SYSTEMS

The SVE systems may require a Permit to Install (PTI) New Sources as a new air contaminant source. The Canton City Health Department, Division of Air Pollution Control, has regulatory authority to enforce the state air pollution control regulations. Under OAC 3745-31, which addresses PTIs, there is a list of exemptions for obtaining a PTI. Specifically, there is a permit-by-rule exemption for SVE systems under OAC 3745-31-03(A)(4)(d). It is stated that soil vapor extraction remediation activities located at facilities that have a total combined emissions rates less than 15 pounds of organic compounds per day are hereby exempted from the permit-to-install requirements for a period of 18 months from the beginning of vapor extraction activities

as long as the owner or operator provides the Director with specified information prior to beginning actual construction. As such, a copy of the design report will be submitted to the Canton Air Group with any additional required information. A meeting will then be scheduled with the Canton Air Group to discuss and agree to an approval/permitting approach.

A copy of the air permitting/approval submittal and subsequent correspondence will be provided to the U.S. EPA.

6. PROJECT MANAGEMENT AND PLANNING

6.1 CONTACT INFORMATION

At the direction of Wyeth and WKI, WESTON will manage all phases of the project. WESTON will perform the field construction, prepare the reports, and perform all subsequent studies. Project management will be provided by Matt Basso (Wyeth), Jeff Burman (WKI), and Ken Bardo (U.S. EPA RCRA Project Manager [RPM]). Management responsibilities of key project personnel are defined in Subsection 7.2. Contact information is provided in the following table:

Name/Title	Company	Address	Phone/Fax	e-mail
Matt Basso/Project Manager	Wyeth	100 Campus Dr., Florham Park, NJ 07932	Ph: (973)683-2273 Fax: (973) 683-2281	bassom@wyeth.com
Jeff Burman/Project Manager.	WKI	359 State St. ext. NW, Massillon, OH 44648	Ph: (330) 832-5026 Fax: (330) 833-8003	BurmanJL@WorldKitchen.com
Ken Bardo/Project Manager	U.S. EPA (V)	77 W. Jackson Blvd, Chicago, IL 60604	Ph: (312) 886-7566 Fax: (312) 353-4342	Bardo.ken@epa.gov
Tom Cornuet/Technical Consultant Leader	WESTON	1400 Weston Way, West Chester, PA 19380	Ph: (610) 701-7360 Fax: (610) 701-7401	tom.cornuet@westonsolutions.com
Eric Lang/Laboratory Manager	Severn Trent Laboratory	2417 Bond St., University Park, IL 60466	Ph: (708) 534-5200 Fax: (708) 534-5211	Elang@STL-inc.com

6.2 ROLES AND RESPONSIBILITIES

The Wyeth Project Manager, Mr. Matt Basso, is responsible for implementation of the Administrative Order on Consent (Consent Order) and Scope of Work. The U.S. EPA Region V has approved the Consent Order and Consent Order Scope of Work. The U.S. EPA Project Manager, Mr. Ken Bardo, will provide oversight for the project. The WKI Project Manager, Mr. Jeff Burman, is responsible for providing Wyeth and its contractors access to the facility, and WKI's records relating to the Consent Order.

The WESTON Technical Consultant Leader, Mr. Tom Cornuet, is responsible for implementing the project, and has been provided the authority from Wyeth and WKI to commit the resources necessary to meet project objectives and requirements. WESTON's primary function is to ensure that technical, construction, financial, and scheduling objectives are achieved.

Mr. Cornuet reports directly to the Wyeth Project Manager, Mr. Basso, and is responsible for ensuring that the project meets U.S. EPA's objectives and WESTON quality standards. Mr. Cornuet is also responsible for technical quality control (QC) and project management.

Mr. Cornuet will be supported by the WESTON field team leaders. The WESTON field team leaders are responsible for leading and coordinating the day-to-day activities of the various resource specialists under his/her supervision. The technical construction and operation staff for this project will be drawn from WESTON's pool of corporate resources. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work. WESTON will utilize specialized subcontractors for laboratory analysis (Severn Trent Laboratory), equipment suppliers, drillers, and trade construction (electrical).

7. SCHEDULE

The project schedule for the construction and operation of the corrective measures at the WKI facility is provided in Table 1 of Attachment 2 to the Consent Order. A more detailed construction schedule with additional interim activities and dates is provided below.

Event	Date
Execution of Consent Order	8/26/02
Submit a Design Report for implementing IS-2, OS-3, and GW-6	11/25/02 (90 days)*
Submit emissions information to City of Canton Health Dept., Air Pollution Control	1/15/03
Submit air sparge injection information to the DDAGW UIC permit group	1/15/03
Obtain local and state regulatory concurrence	2/1/03
Begin site preparation/mobilization	3/1/03
Begin construction – install vents	3/15/03
Begin blower and piping installation	3/21/03
Complete construction and begin operation of the corrective measures	8/26/03 (12 months)*
Submit a Construction Completion Report and Operation and Maintenance Plan for corrective measures at the WKI Facility	11/26/03 (15 months)*

* Due date required under the Consent Order. The time from the execution date of the Consent Order is shown in parentheses.

8. REFERENCES

U.S. EPA. 1996. *Soil Screening Guidance: User Guide.* OSWER Publication 9355.4-23. April 1996.

U.S. EPA, Office of Solid Waste, Office of Waste Programs Enforcement. 1994. *RCRA Corrective Action Plan*. OSWER Dir. 9902.3-2A.

Roy F. Weston, Inc. 2002. "2001 Groundwater Monitoring Report for the World Kitchen, Inc., Massillon, Ohio, Facility."

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Roy F. Weston, Inc. 1994. "Interim Remedial Measures, EKCO Housewares Facility, Massillon, Ohio."

Roy F. Weston, Inc. 1993. "Corrective Measures Study, EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1993. "RCRA Facility Investigation Report for EKCO Housewares, Inc., Massillon, Ohio."

Roy F. Weston, Inc. 1988. "Interim Measures Report for EKCO Housewares, Inc., Massillon, Ohio."

APPENDIX A
HISTORICAL DATA AND SUPPLEMENTARY INFORMATION

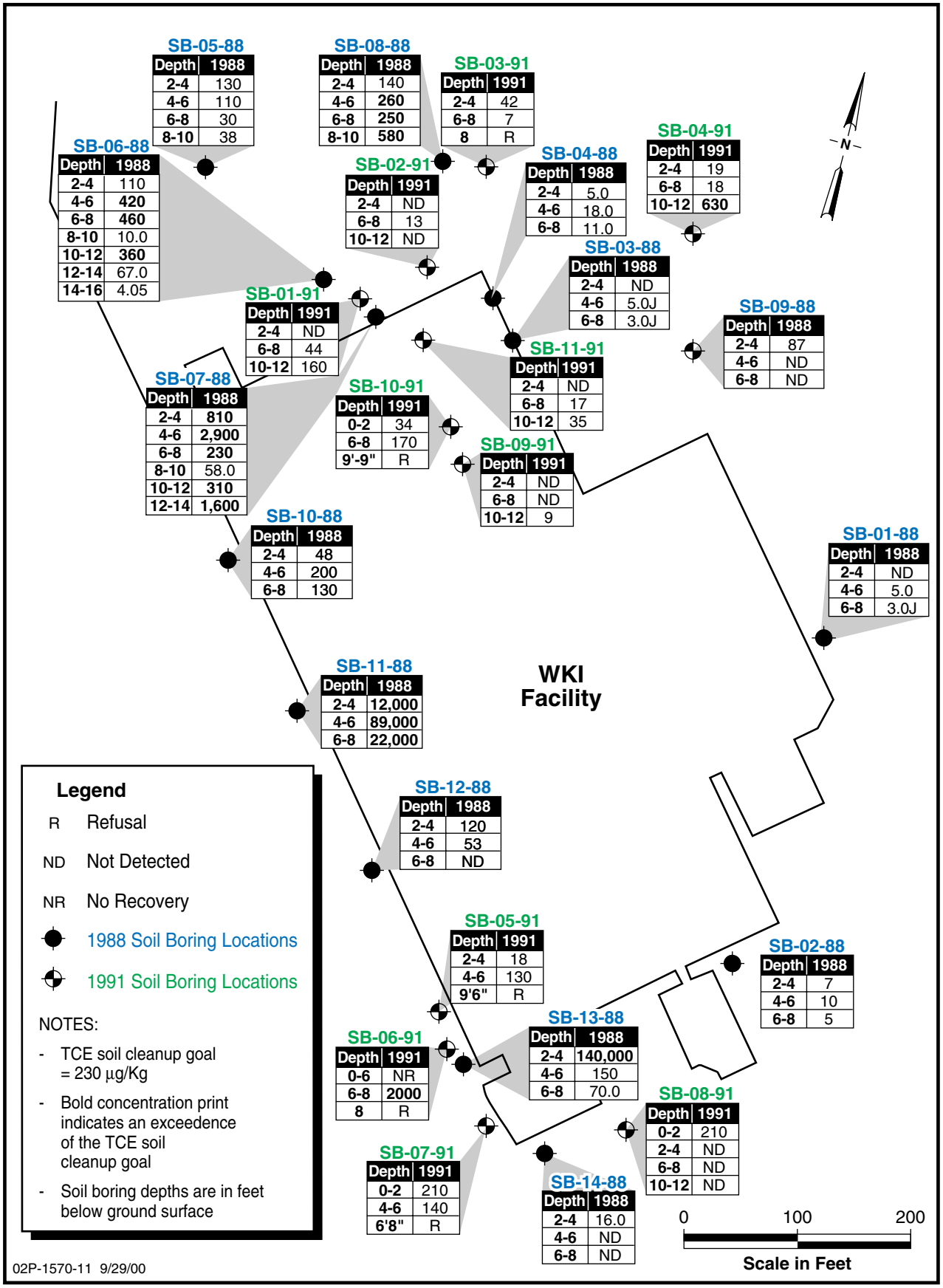


FIGURE A-1 1988 AND 1991 TRICHLOROETHENE (TCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

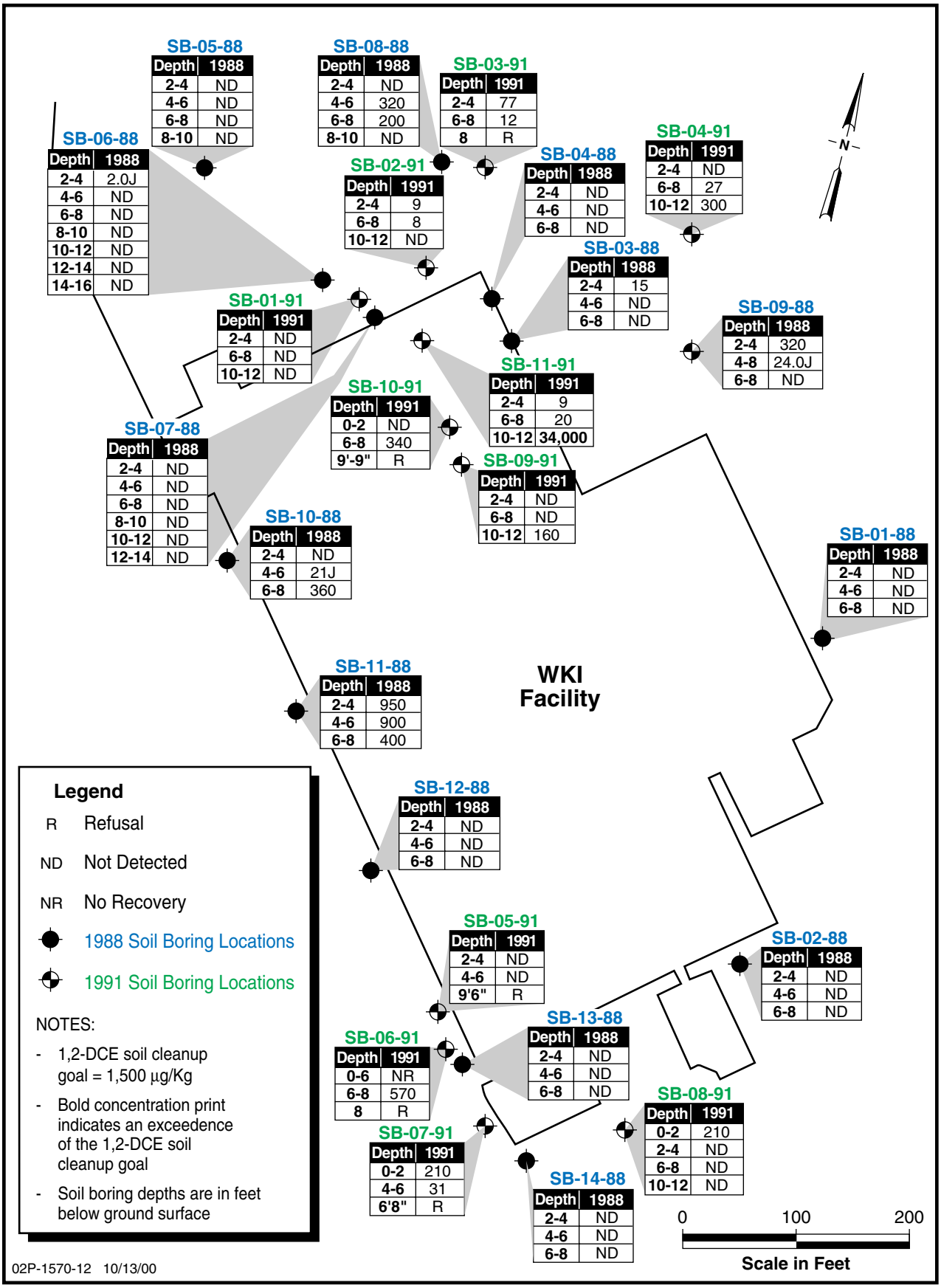


FIGURE A-2 1988 AND 1991 CIS - 1,2 DICHLOROETHENE (1,2-DCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

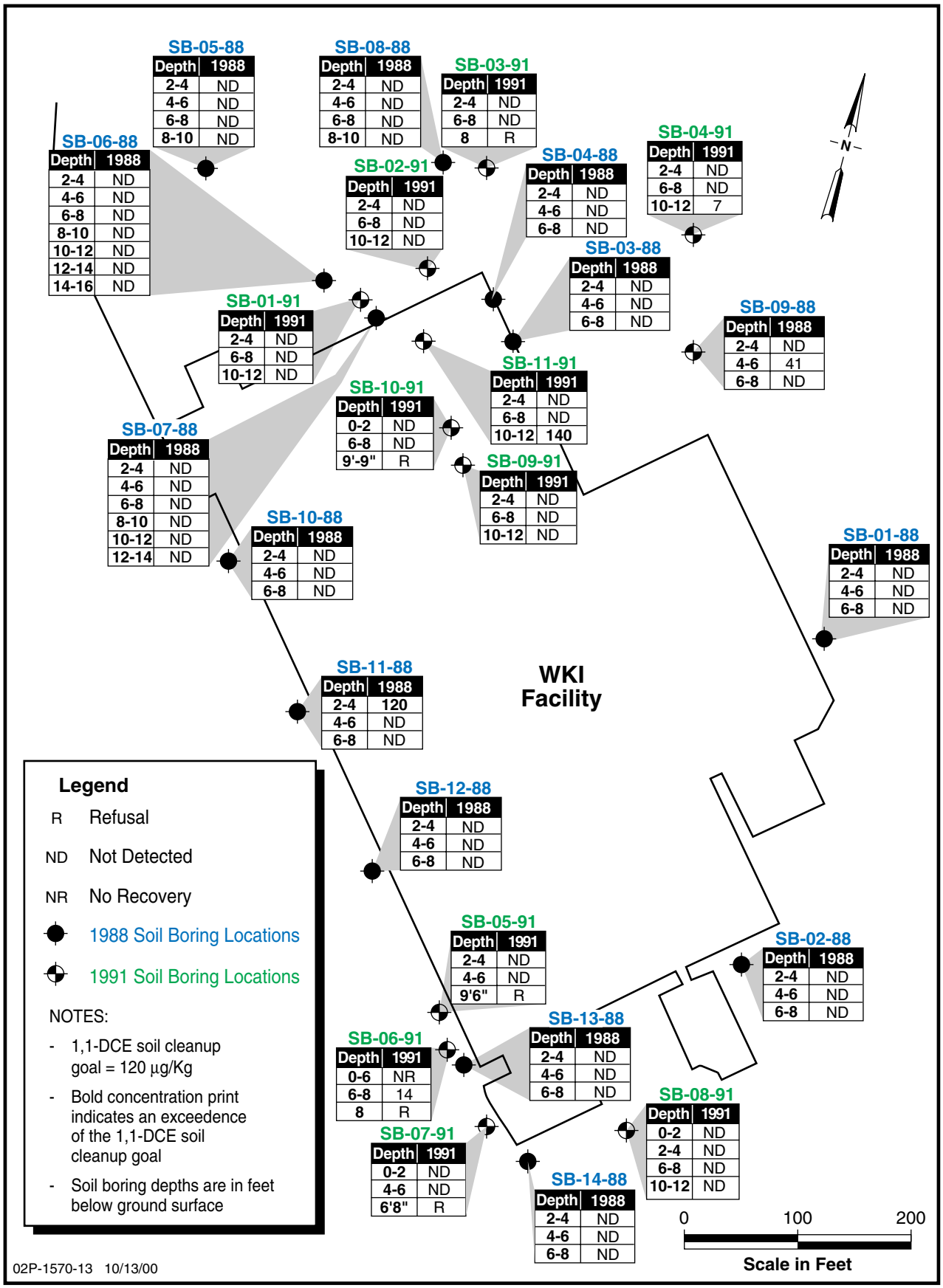


FIGURE A-3 1988 AND 1991 1,1 DICHLOROETHENE (1,1-DCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

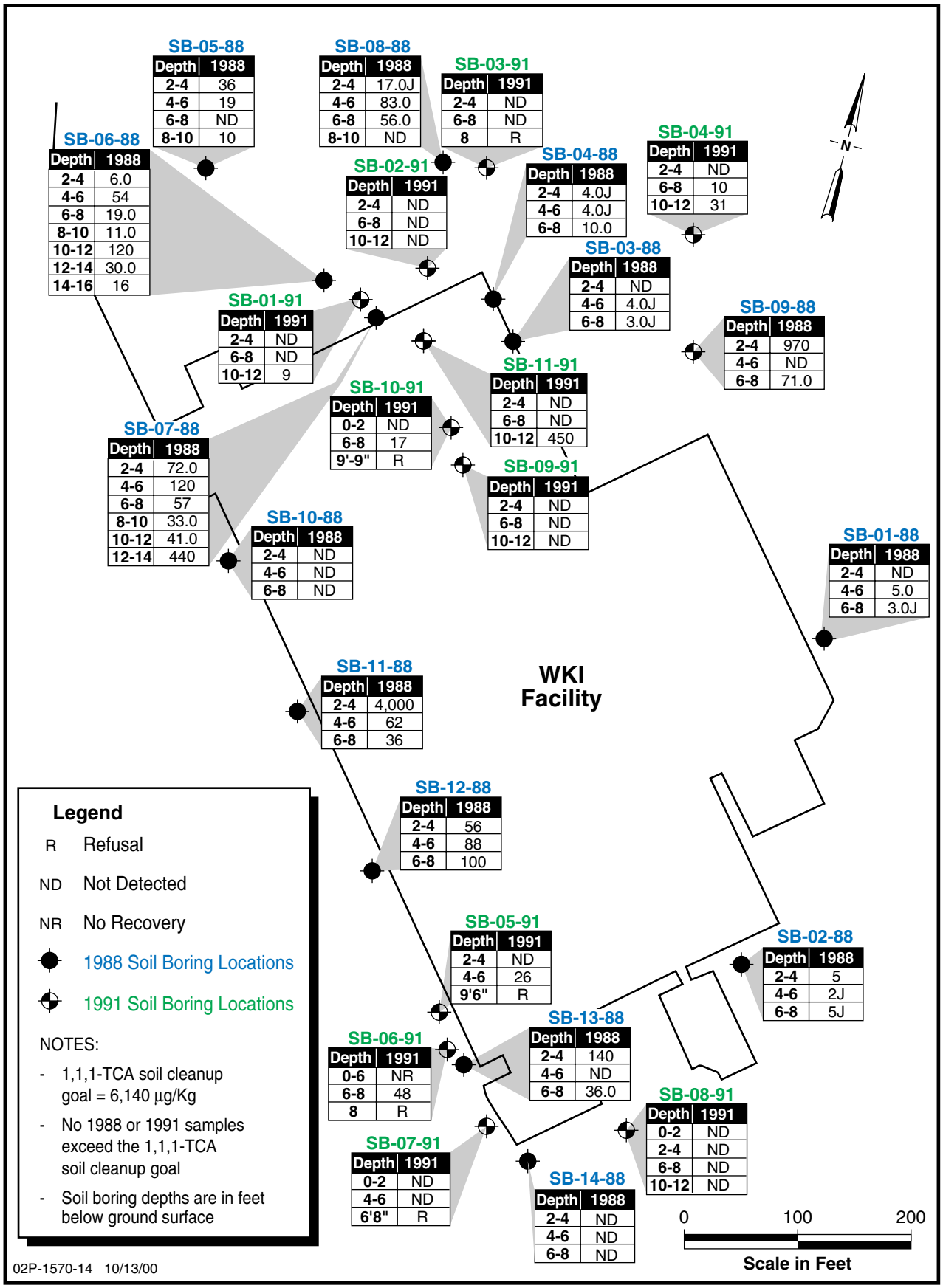


FIGURE A-4 1988 AND 1991 1,1,1 TRICHLOROETHANE (1,1,1-TCA) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

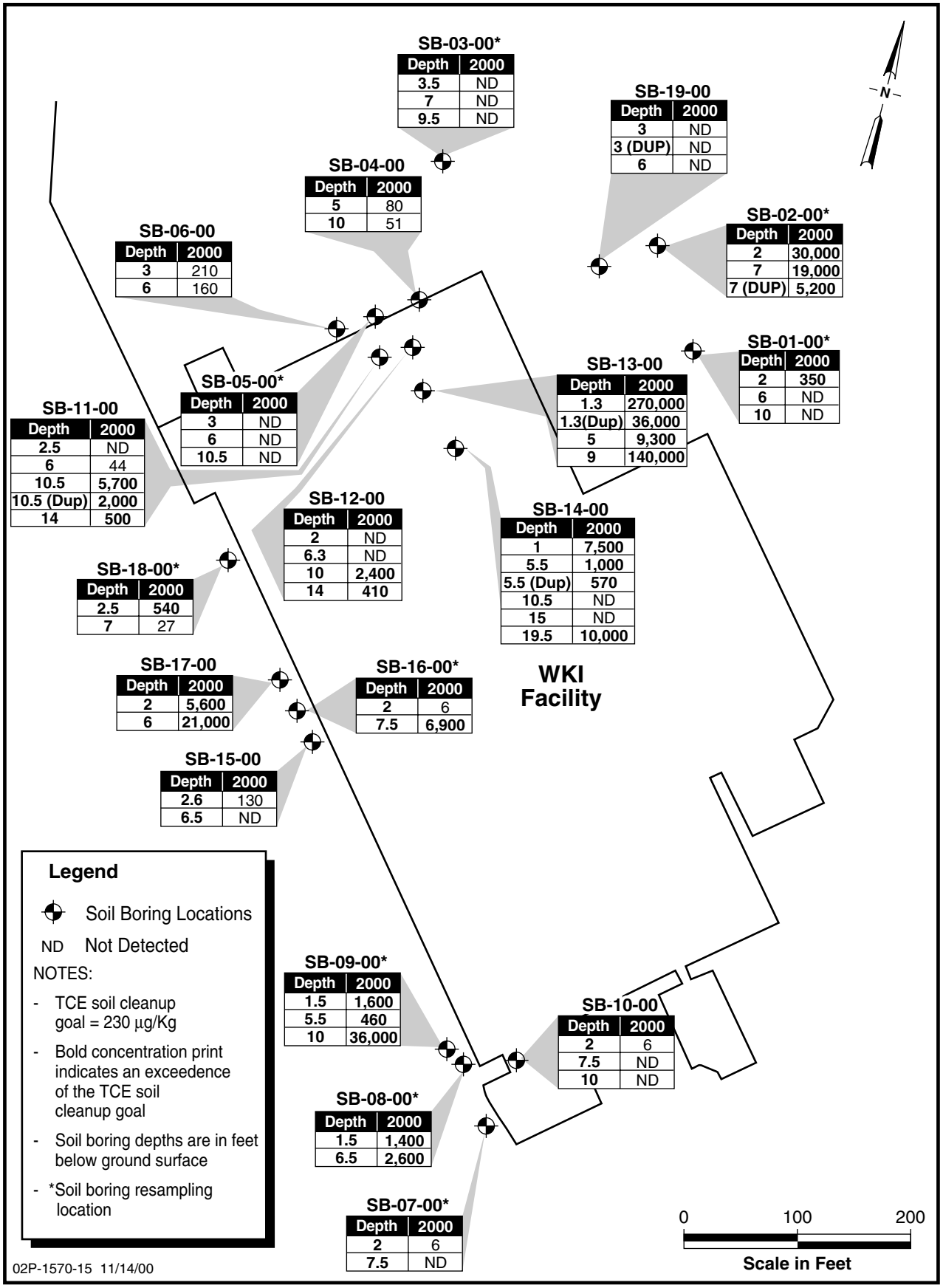


FIGURE A-5 SEPTEMBER 2000 TRICHLOROETHENE (TCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

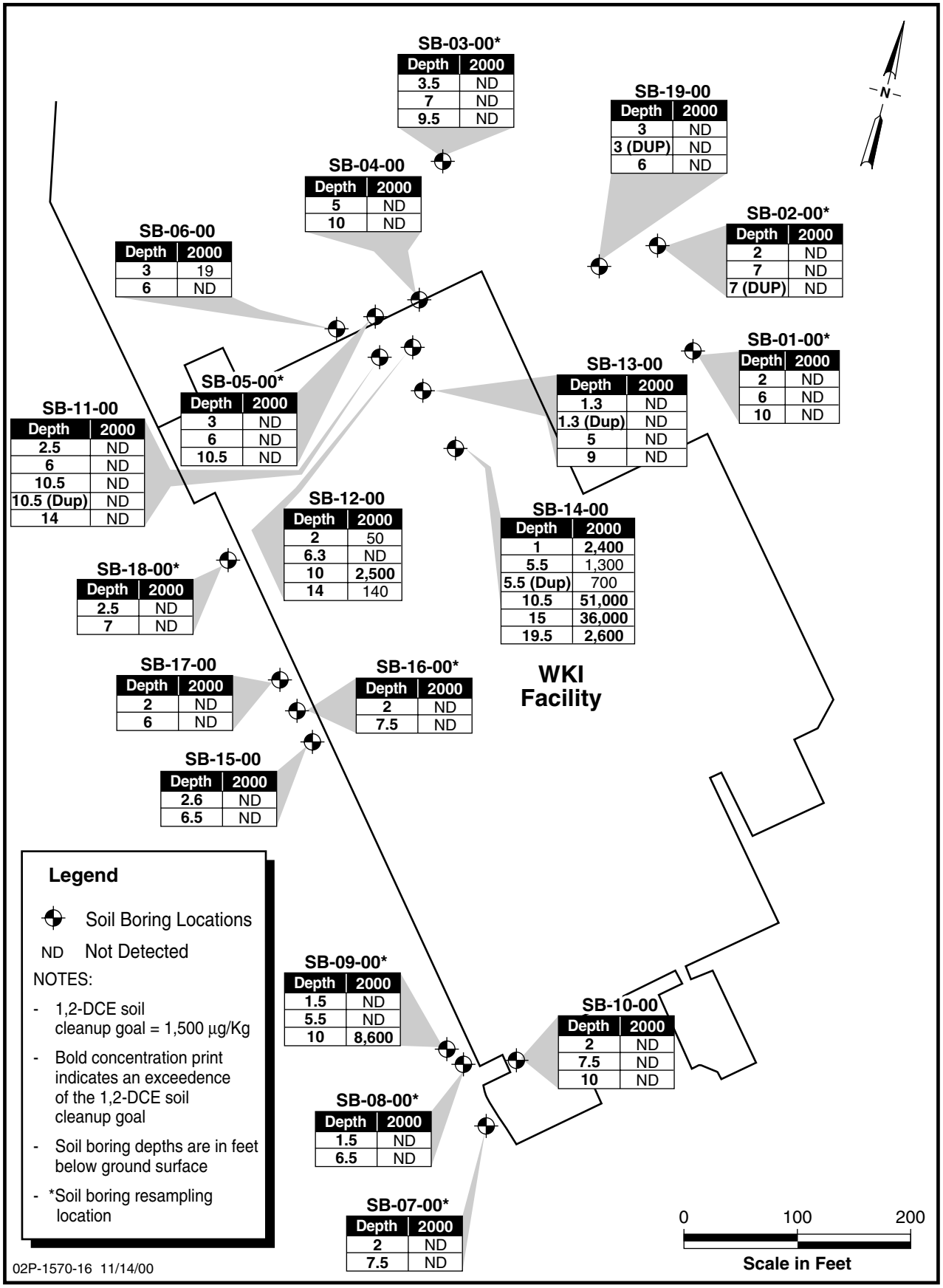


FIGURE A-6 SEPTEMBER 2000 CIS - 1,2 DICHLOROETHENE (1,2-DCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

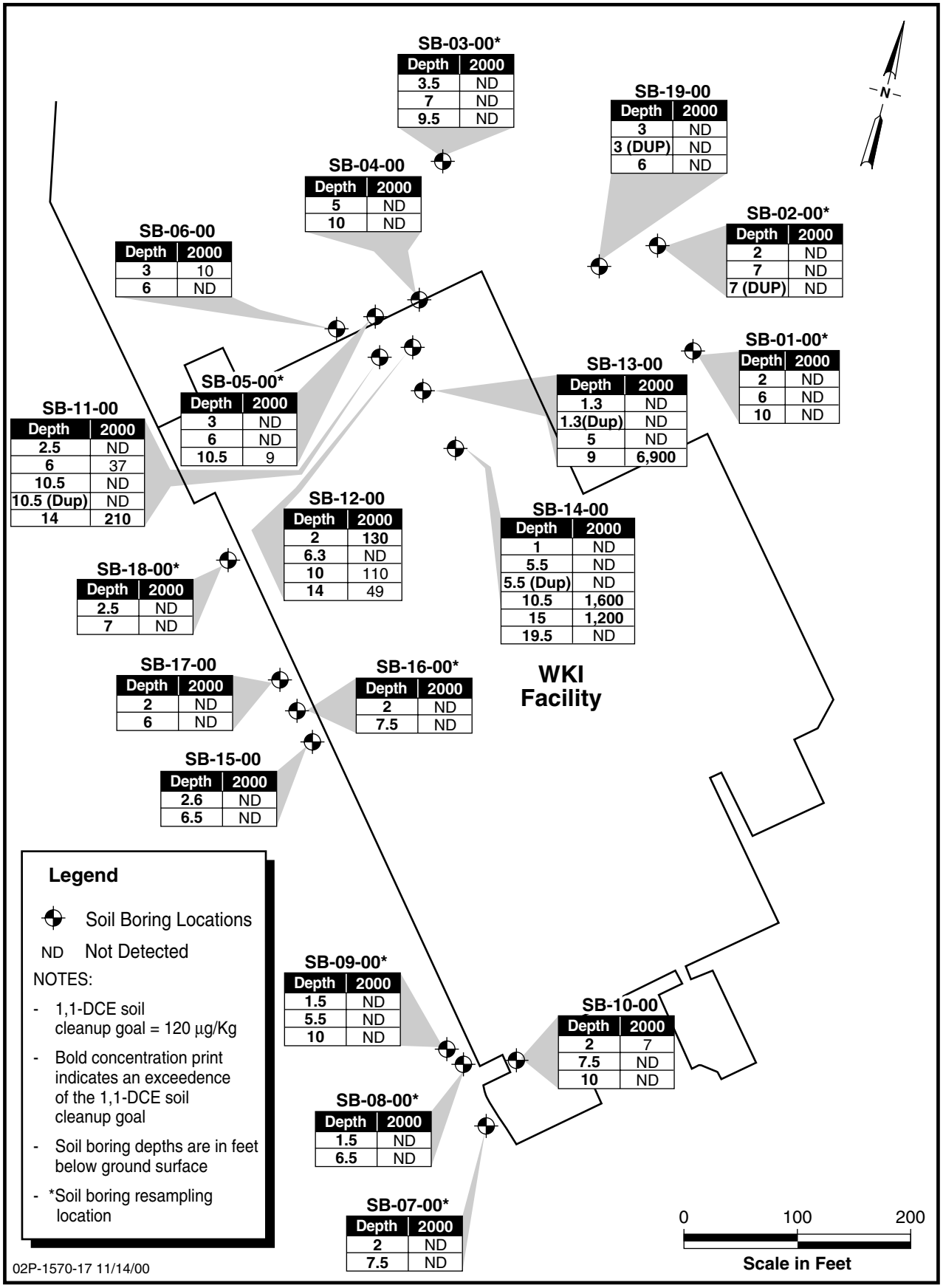


FIGURE A-7 SEPTEMBER 2000 1,1 DICHLOROETHENE (1,1-DCE) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

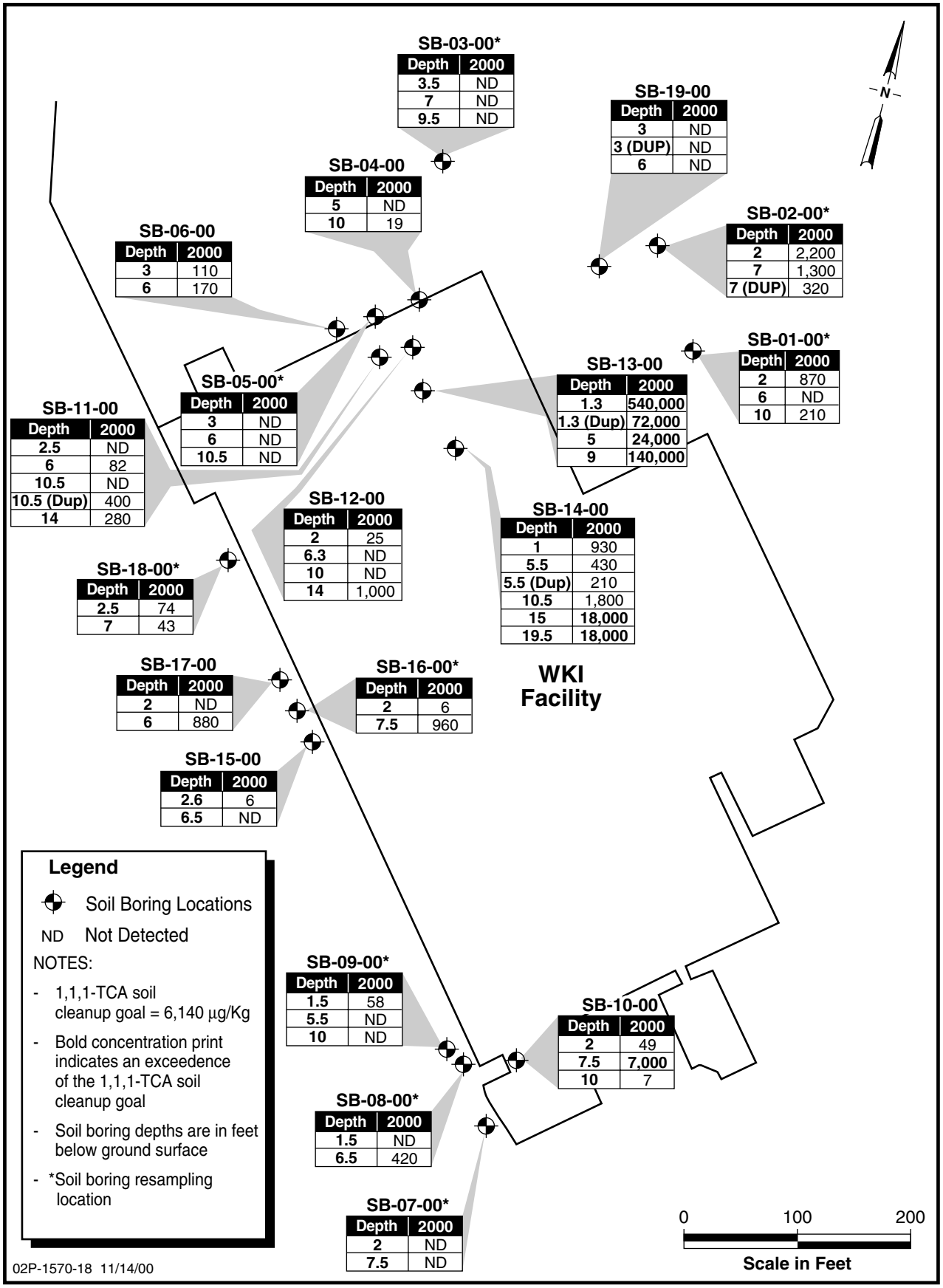


FIGURE A-8 SEPTEMBER 2000 1,1,1 TRICHLOROETHANE (1,1,1-TCA) CONCENTRATIONS (µg/kg) IN SOIL BORING SAMPLES

Table A-1
North Area - Outside
September 2000 Geoprobe Soil Sampling Results (µg/kg)
World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14298	14299	14300	14301	14302	14303	14461	14462	14463
Soil Boring Number:	SB-01			SB-02			SB-19		
Sample Depth (ft bgs):	2	6	10	2	7	7 (DUP)	3	3 (DUP)	6
Multiplier:	*10*	1	1	189	132	27	1	1	1
COMPOUND									
Trichloroethene	**350**	<R.L.	<R.L.	**30,100**	**19,100**	**5,200**	<R.L.	<R.L.	<R.L.
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	870	<R.L.	210	2,200	1,300	320	<R.L.	<R.L.	<R.L.

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of soil cleanup goals
(DUP) - Duplicate sample

Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table A-1 (Continued)
North Area - Outside
September 2000 Geoprobe Soil Sampling Results (µg/kg)
World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14304	14305	14306	14307	14308	14309	14310	14311	14312	14313
Soil Boring Number:	SB-03			SB-04		SB-05			SB-06	
Sample Depth (ft bgs):	3.5	7	9.5	5	10	3	6	10.5	3	6
Multiplier:	10	10	*1*	1	1	1	1	1	1	1
COMPOUND										
Trichloroethene	<R.L.	<R.L.	<R.L.	80	51	<R.L.	<R.L.	<R.L.	209	158
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	9	10	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	19	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	<R.L.	<R.L.	<R.L.	<R.L.	19	<R.L.	<R.L.	<R.L.	113	168

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of soil cleanup goals
(DUP) - Duplicate sample

Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table A-2
Southwest Area
September 2000 Geoprobe Soil Sampling Results (µg/kg)
World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14383	14384	14385	14386	14387	14388	14389	14390	14391	14392
Soil Boring Number:	SB-07		SB-08		SB-09			SB-10		
Sample Depth (ft bgs):	2	7.5	1.5	6.5	1.5	5.5	10	2	7.5	10
Multiplier:	1	1	10	32	10	10	313	1	39	1
COMPOUND										
Trichloroethene	6	<R.L.	**1,350**	**2,650**	**1,630**	**460**	**35,600**	6	<R.L.	<R.L.
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	7	<R.L.	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	**8,560**	<R.L.	<R.L.	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	<R.L.	<R.L.	<R.L.	420	58	<R.L.	<R.L.	<R.L.	**6,950**	7

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of soil cleanup goals
(DUP) - Duplicate sample

Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table A-3
North Area - Inside
September 2000 Geoprobe Soil Sampling Results (µg/kg)
World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	**14395**	**14396**	**14397**	**14398**	**14399**	**14400**	**14401**	**14402**	**14403**	**14404**	**14405**	**14406**	**14407**	**14408**	**14409**	**14410**	**14411**	**14412**	**14413**
Soil Boring Number:	**SB-11**					**SB-12**				**SB-13**				**SB-14**					
Sample Depth (ft bgs):	**2.5**	**6**	**10.5**	**10.5 (DUP)**	**14**	**2**	**6.3**	**10**	**14**	**1.3**	**1.3 (DUP)**	**5**	**9**	**1**	**5.5**	**5.5 (DUP)**	**10.5**	**15**	**19.5**
Multiplier:	**1**	**1**	**35**	**36**	**2.5**	**1**	**1**	**37**	**5**	**3580**	**3300**	**166**	**850**	**34**	**31**	**9**	**201**	**186**	**180**
COMPOUND																			
Trichloroethene	<R.L.	44	**5,720**	**2,050**	**500**	<R.L.	<R.L.	<R.L.	**410**	**273,000**	**36,100**	**9,290**	**137,000**	**7,540**	**1,280**	**570**	<R.L.	<R.L.	**10,000**
1,1-Dichloroethene	<R.L.	37	<R.L.	<R.L.	**210**	**131**	<R.L.	111	49	<R.L.	<R.L.	<R.L.	**6,900**	<R.L.	<R.L.	<R.L.	**1,640**	**1,220**	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	0.05	<R.L.	**2,470**	145	<R.L.	<R.L.	<R.L.	<R.L.	**2,380**	1,290	700	**50,800**	**36,200**	**2,570**
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	**1,770**	<R.L.	<R.L.
1,1,1-Trichloroethane	<R.L.	82	<R.L.	400	277	25	<R.L.	2,400	1,020	**544,000**	**71,800**	**24,200**	**140,000**	930	430	210	1,820	**17,900**	**17,800**

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of soil cleanup goals
(DUP) - Duplicate sample

Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table A-4
West Area
September 2000 Geoprobe Soil Sampling Results (µg/kg)
World Kitchen, Massillon, Ohio, Facility

Laboratory ID Number:	14453	14454	14455	14456	14457	14458	14459	14560	14461	14462	14463
Soil Boring Number:	SB-15		SB-16		SB-17		SB-18		SB-19		
Sample Depth (ft bgs):	2.6	6.5	2	7.5	2	6	2.5	7	3	3 (DUP)	6
Multiplier:	1	1	1	30	78	157	2.5	1	1	1	1
COMPOUND											
Trichloroethene	130	<R.L.	6	**6,930**	**5,580**	**20,900**	**540**	27	<R.L.	<R.L.	<R.L.
1,1-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
cis-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
trans-1,2-Dichloroethene	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.	<R.L.
1,1,1-Trichloroethane	6	<R.L.	6	960	<R.L.	880	74	43	<R.L.	<R.L.	<R.L.

R.L. = 5.0 x multiplier
Bold print indicates an exceedance of soil cleanup goals
(DUP) - Duplicate sample

Soil Cleanup Goals	
COMPOUND	**GOAL (µg/kg)**
Trichloroethene	230
1,1-Dichloroethene	120
cis-1,2-Dichloroethene	1,500
1,1,1-Trichloroethane	6,140

Table A-5

Pumping Rates and Total VOCs Detected for Recovery Wells W-1 and W-10 February 1990 through December 2001

Recovery Well W-1				Recovery Well W-10			
Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)	Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)
2/1/1990	250	9,595,000	142	2/1/1990	360	13,996,200	1,923
3/5/1990	260	11,648,000	117	3/5/1990	360	16,368,200	2,173
4/3/1990	260	10,847,000	109	4/3/1990	350	14,577,000	1,832
5/2/1990	260	10,799,000	131	5/2/1990	340	14,133,099	2,849
6/4/1990	255	12,310,000	146	6/4/1990	330	16,000,700	2,597
7/6/1990	265	11,946,000	173	7/6/1990	330	15,051,200	2,540
8/3/1990	260	10,541,000	173	8/3/1990	320	13,180,600	2,378
9/5/1990	260	12,319,000	158	9/5/1990	325	13,845,800	2,140
10/2/1990	260	10,020,000	150	10/2/1990	340	12,895,300	2,163
11/1/1990	260	11,106,000	132	11/1/1990	350	14,958,000	2,776
12/4/1990	260	12,120,000	150	12/4/1990	340	16,588,600	3,069
1/7/1991	260	12,470,000	180	1/7/1991	335	16,720,500	2,850
2/1/1991	260	9,342,000	173	2/1/1991	340	12,085,300	2,153
3/8/1991	255	12,871,000	179	3/8/1991	335	16,758,399	2,286
4/1/1991	250	8,634,000	175	4/1/1991	325	11,265,200	1,873
5/1/1991	210	9,789,000	181	5/1/1991	320	13,868,800	1,610
6/4/1991	210	10,055,000	264	6/4/1991	310	15,440,399	2,384
7/1/1991	205	3,211,920	303	7/1/1991	260	4,938,500	2,436
8/1/1991	200	9,156,000	248	8/1/1991	265	11,861,000	1,965
9/3/1991	210	9,767,000	302	9/3/1991	270	12,835,400	2,182
10/3/1991	200	8,452,000	233	10/3/1991	280	11,722,800	1,876
11/5/1991	205	9,507,000	208	11/5/1991	265	12,592,500	1,498
12/13/1991	205	10,847,000	256	12/13/1991	265	14,287,000	1,554
1/6/1992	280	2,882,000	**	1/6/1992	280	9,372,000	1,594
2/7/1992	*	*	**	2/7/1992	285	12,845,900	1,744
3/6/1992	205	5,313,000	4,726	3/6/1992	270	4,729,100	3,928
4/13/1992	220	12,038,400	138	4/13/1992	240	10,656,900	827
5/5/1992	220	6,857,000	174	5/5/1992	235	7,570,000	1,418
6/2/1992	210	8,584,000	218	6/2/1992	265	10,566,300	1,206
7/1/1992	220	8,757,000	71	7/1/1992	270	10,848,400	1,470
8/4/1992	230	10,365,000	165	8/4/1992	275	13,297,500	1,538
9/2/1992	220	9,155,000	169	9/2/1992	280	11,747,000	1,830
10/3/1992	230	9,566,000	177	10/3/1992	295	12,405,700	1,226
11/3/1992	230	10,296,000	148	11/3/1992	305	13,744,400	1,489
12/8/1992	230	11,646,000	175	12/8/1992	300	15,364,800	1,298
1/6/1993	230	10,086,000	135	1/6/1993	310	13,320,800	666
2/3/1993	245	9,073,000	183	2/3/1993	315	11,889,900	2,162
3/2/1993	230	9,065,000	135	3/2/1993	300	11,764,300	1,420
4/1/1993	230	8,373,000	162	4/1/1993	310	12,000,900	1,954
5/3/1993	235	10,938,000	136	5/3/1993	305	14,383,000	1,673
6/1/1993	230	9,408,000	ND	6/1/1993	310	12,023,000	1,592
7/1/1993	230	9,408,000	124	7/1/1993	300	12,493,900	1,660
8/9/1993	210	11,727,000	132	8/9/1993	305	16,701,000	1,546

Table A-5

Pumping Rates and Total VOCs Detected for Recovery Wells W-1 and W-10 February 1990 through December 2001

Recovery Well W-1				Recovery Well W-10			
Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)	Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)
9/2/1993	190	6,655,000	140	9/2/1993	300	10,205,000	1,660
10/1/1993	175	7,505,000	136	10/1/1993	289	12,194,500	1,486
11/3/1993	200	7,000,000	**	11/3/1993	294	11,044,200	1,422
12/1/1993	*	*	**	12/1/1993	300	12,173,200	1,263
1/13/1994	300	19,000,000	136	1/13/1994	290	18,560,500	1,534
2/14/1994	145	9,612,000	138	2/14/1994	295	13,229,800	1,779
3/3/1994	245	10,584,000	144	3/3/1994	295	7,058,400	1,860
4/19/1994	245	14,102,000	141	4/19/1994	290	11,995,200	2,040
5/5/1994	245	5,644,800	144	5/5/1994	290	6,604,100	1,788
6/3/1994	245	9,878,000	158	6/3/1994	*	*	**
7/11/1994	280	15,590,000	187	7/11/1994	300	17,280,000	1,801
8/9/1994	245	9,172,800	129	8/9/1994	235	8,798,400	1,694
9/28/1994	230	15,906,000	167	9/28/1994	*	*	**
10/17/1994	230	6,624,000	170	10/17/1994	315	9,072,000	2,282
11/4/1994	230	5,961,600	152	11/4/1994	315	8,164,800	1,374
12/13/1994	270	13,223,000	136	12/13/1994	320	18,011,300	958
1/5/1995	240	7,919,000	166	1/5/1995	320	10,615,900	1,163
2/3/1995	240	10,022,400	170	2/3/1995	320	13,363,200	1,082
3/13/1995	230	13,923,000	186	3/13/1995	350	18,630,700	1,016
4/5/1995	220	5,254,000	114	4/5/1995	355	8,046,800	1,088
5/8/1995	220	10,493,000	108	5/8/1995	365	16,519,000	1,287
6/7/1995	220	8,940,000	80	6/7/1995	365	15,674,400	909
7/12/1995	270	12,200,000	217	7/12/1995	*	*	**
8/16/1995	220	11,003,000	56	8/16/1995	350	17,136,000	1,179
9/26/1995	200	15,110,000	246	9/26/1995	*	*	**
10/25/1995	220	10,001,000	260	10/25/1995	330	8,276,700	2,548
11/7/1995	220	400,900	167	11/7/1995	340	6,739,200	813
12/7/1995	215	9,349,000	122	12/7/1995	345	16,056,000	942
1/26/1996	220	11,884,000	114	1/26/1996	340	19,096,400	1,263
2/29/1996	230	4,069,000	120	2/29/1996	360	7,241,800	762
3/15/1996	230	11,505,000	77	3/15/1996	360	18,152,000	1,070
4/12/1996	230	4,200,000	89	4/12/1996	370	14,820,700	951
5/7/1996	230	8,076,000	74	5/7/1996	375	13,299,100	791
6/7/1996	*	*	**	6/7/1996	405	16,989,700	978
7/29/1996	*	*	**	7/29/1996	395	29,864,900	803
8/15/1996	230	14,940,000	83	8/15/1996	355	8,798,200	663
9/13/1996	230	9,630,000	103	9/13/1996	345	14,661,300	1,274
10/10/1996	230	9,027,000	129	10/10/1996	350	13,525,100	1,243
11/13/1996	230	11,384,000	129	11/13/1996	325	17,167,400	1,081
12/10/1996	230	8,945,000	118	12/10/1996	350	13,653,400	1,191
1/10/1997	230	10,392,000	154	1/10/1997	350	15,748,700	1,166
2/28/1997	230	14,864,000	91	2/28/1997	330	24,466,100	1,297
3/19/1997	220	5,675,000	236	3/19/1997	360	9,114,000	2,296

Table A-5

Pumping Rates and Total VOCs Detected for Recovery Wells W-1 and W-10 February 1990 through December 2001

Recovery Well W-1				Recovery Well W-10			
Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)	Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)
4/3/1997	220	510,699,000	215	4/3/1997	325	8,003,300	2,940
5/13/1997	220	12,481,000	101	5/13/1997	360	20,426,200	922
6/13/1997	215	9,636,000	231	6/13/1997	350	15,873,700	1474
7/10/1997	215	8,234,000	75	7/10/1997	340	13,564,600	701
8/6/1997	210	8,161,000	92	8/6/1997	335	13,063,700	992
9/12/1997	210	7,999,000	611	9/12/1997	*	*	**
10/8/1997	210	7,854,000	314	10/8/1997	340	15,853,000	763
11/20/1997	210	13,032,000	108	11/20/1997	340	21,052,000	913
12/16/1997	210	7,688,000	105	12/16/1997	300	1,836,800	946
1/29/1998	220	13,429,000	115	1/29/1998	*	*	**
2/12/1998	225	4,232,000	94	2/12/1998	280	12,992,500	1268
3/19/1998	215	10,453,000	142	3/19/1998	*	*	**
4/29/1998	215	12,598,000	207	4/29/1998	*	*	**
5/21/1998	205	6,525,000	164	5/21/1998	*	*	**
6/25/1998	*	*	**	6/25/1998	350	17,281,800	877
7/23/1998	*	*	**	7/23/1998	285	10,452,700	968
8/27/1998	*	*	**	8/27/1998	280	10,023,300	1118
9/22/1998	*	*	**	9/22/1998	295	6,459,500	1179
10/27/1998	210	8,628,000	91	10/27/1998	260	12,962,200	1092
11/30/1998	*	*	**	11/30/1998	295	13,446,000	936
12/17/1998	200	5,274,000	99	12/17/1998	275	6,954,200	1012
1/28/1999	200	12,230,000	107	1/28/1999	280	16,674,300	1035
2/25/1999	200	8,062,000	112	2/25/1999	285	11,197,200	1399
3/25/1999	200	8,038,000	57	3/25/1999	285	11,527,600	1417
4/28/1999	200	9,504,000	82	4/28/1999	305	14,510,100	992
5/27/1999	200	8,352,000	87	5/27/1999	260	10,948,600	1003
6/30/1999	195	9,266,400	85	6/30/1999	260	11,876,000	1082
7/28/1999	195	7,862,400	89	7/28/1999	265	10,660,900	1080
8/26/1999	*	*	**	8/26/1999	275	8,346,100	1205
9/30/1999	*	*	**	9/30/1999	250	10,818,100	752
10/28/1999	190	7,660,800	86	10/28/1999	240	9,370,300	759
11/23/1999	195	7,300,800	93	11/23/1999	240	8,847,500	761
12/14/1999	195	4,773,600	110	12/14/1999	240	4,804,000	140
1/26/2000	200	12,740,000	192	1/26/2000	*	*	**
2/17/2000	200	6,358,000	261	2/17/2000	*	*	**
3/29/2000	200	**	158	3/29/2000	240	**	1200
4/13/2000	185	5,328,000	73	4/13/2000	240	6,912,000	1129
5/11/2000	180	7,370,000	122	5/11/2000	240	6,733,600	963
6/27/2000	180	12,118,000	116	6/27/2000	245	15,989,200	991
7/27/2000	175	7,642,000	114	7/27/2000	235	10,006,300	967
8/17/2000	175	5,267,000	105	8/17/2000	235	7,099,900	911
9/14/2000	170	6,889,000	99	9/14/2000	240	9,544,800	970
10/11/2000	170	6,600,000	104	10/11/2000	240	9,244,700	913

Table A-5

Pumping Rates and Total VOCs Detected for Recovery Wells W-1 and W-10 February 1990 through December 2001

Recovery Well W-1				Recovery Well W-10			
Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)	Sample Date	Pumping Rate (gpm)	Water Treated (gallons)	Total VOCs (µg/L)
11/16/2000	170	8,854,000	104	11/16/2000	240	12,222,200	915
12/21/2000	175	8,699,000	97	12/21/2000	240	12,100,300	1033
1/16/2001	175	6,661,000	93	1/16/2001	230	8,748,400	855
2/21/2001	180	9,291,000	104	2/21/2001	235	12,008,100	871
3/29/2001	180	9,585,000	98	3/29/2001	240	12,787,200	1100
4/24/2001	190	7,145,000	103	4/24/2001	255	9,180,000	1098
5/24/2001	180	7,776,000	85	5/24/2001	285	11,790,500	1121
6/14/2001	*	*	*	6/14/2001	295	8,830,300	865
7/26/2001	240	9,782,000	87	7/26/2001	285	16,951,100	781
8/16/2001	240	7,245,000	97	8/16/2001	265	8,180,500	837
9/25/2001	235	13,590,000	58	9/25/2001	265	15,720,300	878
10/30/2001	235	11,643,000	108	10/30/2001	265	13,408,700	882
11/27/2001	225	8,975,000	95	11/27/2001	270	10,698,800	944
12/27/2001	220	9,457,000	84	12/27/2001	275	11,880,000	915

ND = None Detected
* Well not pumping
**Data not available

APPENDIX B
MANUFACTURERS' EQUIPMENT SPECIFICATIONS

BLOWERS

TUTHILL
Vacuum & Blower Systems

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-6937
Fax: (417) 865-2950
blowerxpert@tuthill.com

Application Worksheet (Normal Condition)

Reference/Quote: Weston 10-21-02 - North S\

AMBIENT CONDITIONS:

Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Ambient Temperature:	70 Fahrenheit

APPLICATION REQUIREMENTS:

Gas:	AIR	Gas Properties:	
Molecular Weight:	28.966		
Cp:	0.241	Duty Cycle:	more than 4 hours
K Value (Cp/Cv):	1.398	Relief Vacuum:	10 in. Hg vac
Inlet Temperature:	70 Fahrenheit		
Inlet Volume:	845.1 ICFM		
Standard Volume:	540 SCFM		
Mass Flow:	2430 lbs./hr		
Inlet Pressure:	10.8 in. Hg vac (includes -1.804 in. Hg filter and/or silencer loss)		
Discharge Pressure:	1.662 PSIG (includes 0.162 PSI silencer loss)		

MODEL SELECTED FOR THE APPLICATION:

Model Number:	ACOUSTICAIR 5611-81L3
Materials of Construction	Iron (standard)
Flow Direction	Vertical Flow
Connection Size	6 Flange Inlet 6 Flange Discharge
Seal Type:	Single Envelope Gastight
Lubrication:	Splash
Rotative Speed:	3025 RPM (84.04 % of Max)
Gear Tip Velocity:	4356 ft/min
Discharge Temperature:	210.3 Fahrenheit
Discharge Temperature @ Relief:	231 Fahrenheit
Discharge Volumetric Flow:	613.5 CFM
Required Input Power:	35.53 BHP
Required Input Power @ Relief:	37.8 BHP
Estimated Blower Noise:	94.1 dB(A) at 1 meter, open field
Noise Level Based On:	Inlet filter,inlet silencer and discharge silencer

SELECTED BLOWER OPTIONS:
Standard Viton O-Rings in Mechanical Seals

TESTING
Standard Mechanical Integrity Test

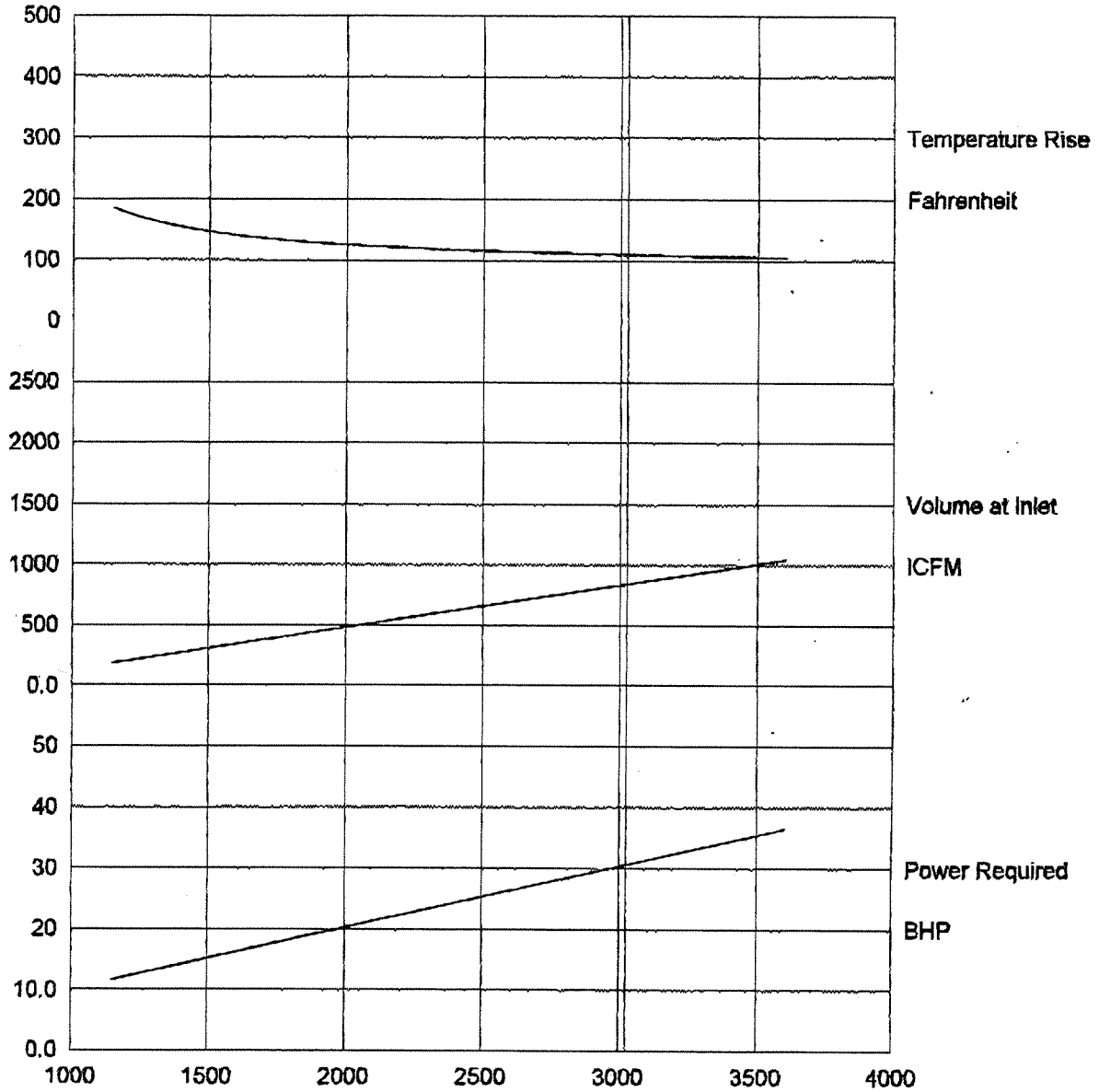
TUTHILL
Vacuum & Blower Systems

Date: 10/22/2002

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-693
Fax: (417) 865-2950
blowerxpert@tuthill.com

Normal Condition Performance Curve for 5611-81L3

Reference/Quote: Weston 10-21-02 - North S



Performance Curve Based Upon The Conditions Of:

Displacement	0.350 CFR
Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Gas:	AIR
Inlet Temperature	70 Fahrenheit
Molecular Weight	28.966
K Value	1.398
Inlet Pressure	10.8 in. Hg vac
Discharge Pressure	1.662 PSIG (includes 0.162 PSI silencer loss)

TUTHILL
Vacuum & Blower Systems

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
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Tel: (417) 865-8715 Toll Free: (800) 825-6937
Fax: (417) 865-2950
blowerxpert@tuthill.com

Application Worksheet (Normal Condition)

Reference/Quote: Weston 10-21-02 East S'

AMBIENT CONDITIONS:

Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Ambient Temperature:	70 Fahrenheit

APPLICATION REQUIREMENTS:

Gas:	AIR	Gas Properties:	
Molecular Weight:	28.966		
Cp:	0.241	Duty Cycle:	more than 4 hours
K Value (Cp/Cv):	1.398	Relief Vacuum:	10 in. Hg vac
Inlet Temperature:	70 Fahrenheit		
Inlet Volume:	535.3 ICFM		
Standard Volume:	360 SCFM		
Mass Flow:	1620 lbs./hr		
Inlet Pressure:	9.802 in. Hg vac (includes -0.802 in. Hg filter and/or silencer loss)		
Discharge Pressure:	1.676 PSIG (includes 0.176 PSI silencer loss)		

MODEL SELECTED FOR THE APPLICATION:

Model Number:	ACOUSTICAIR 5607-81L3
Materials of Construction	Iron (standard)
Flow Direction	Vertical Flow
Connection Size	4 Flange Inlet 4 Flange Discharge
Seal Type:	Single Envelope Gastight
Lubrication:	Splash
Rotative Speed:	2871 RPM (79.74 % of Max)
Gear Tip Velocity:	4133 ft/min
Discharge Temperature:	196.4 Fahrenheit
Discharge Temperature @ Relief:	215.7 Fahrenheit
Discharge Volumetric Flow:	400.2 CFM
Required Input Power:	22.52 BHP
Required Input Power @ Relief:	23.99 BHP
Estimated Blower Noise:	92.3 dB(A) at 1 meter, open field
Noise Level Based On:	Inlet filter,inlet silencer and discharge silencer

SELECTED BLOWER OPTIONS:
Standard Viton O-Rings in Mechanical Seals

TESTING
Standard Mechanical Integrity Test

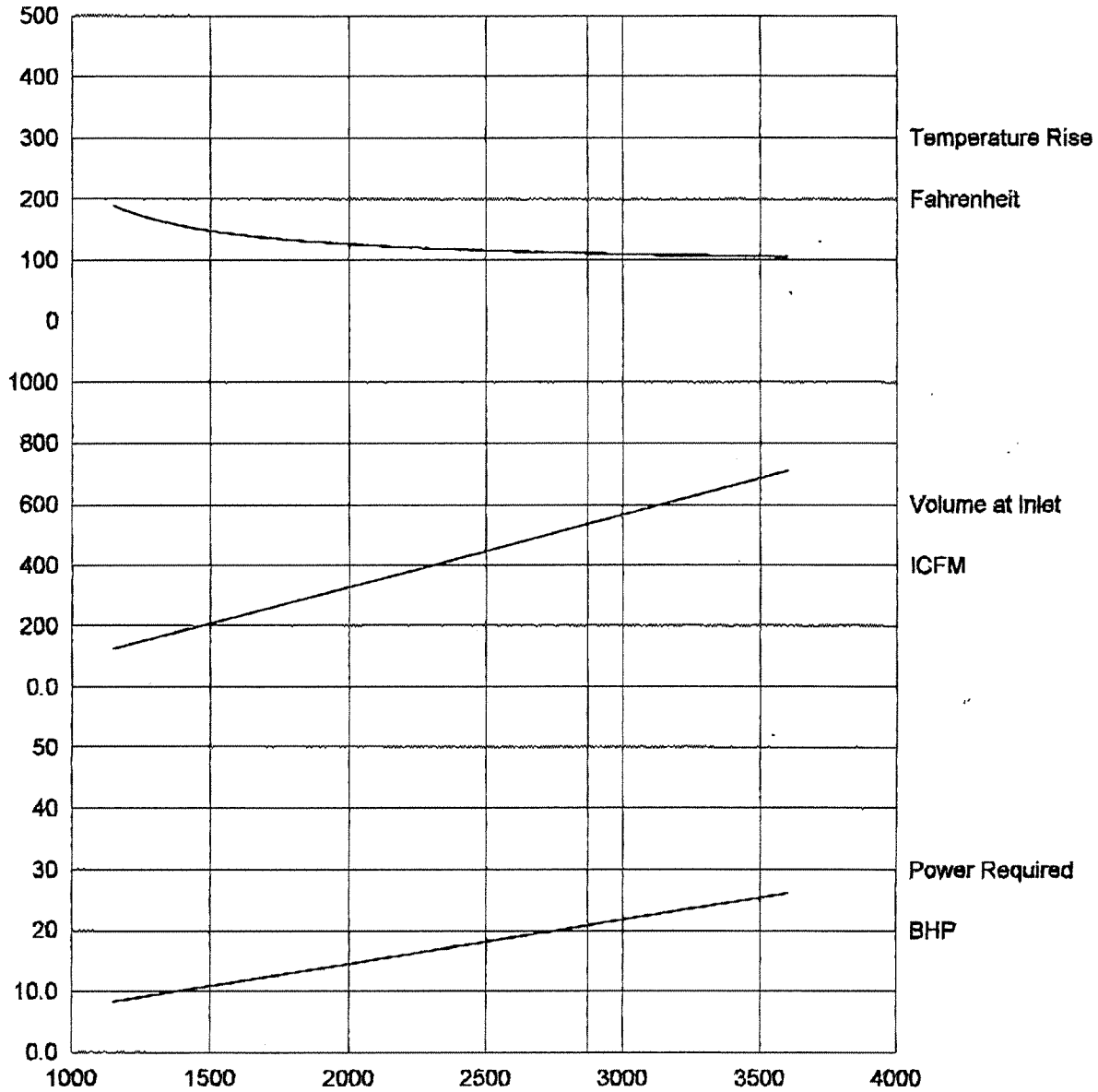
TUTHILL
Vacuum & Blower Systems

Date: 10/22/2002

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-6937
Fax: (417) 865-2950
blowerxpert@tuthill.com

Normal Condition Performance Curve for 5607-81L3

Reference/Quote: Weston 10-21-02 East S\



Performance Curve Based Upon The Conditions Of:

Displacement	0.238 CFR
Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Gas:	AIR
Inlet Temperature	70 Fahrenheit
Molecular Weight	28.966
K Value	1.398
Inlet Pressure	9.802 in. Hg vac
Discharge Pressure	1.676 PSIG (includes 0.176 PSI silencer loss)

TUTHILL
Vacuum & Blower Systems

Date: 10/24/2002

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-6937
Fax: (417) 865-2950
blowerxpert@tuthill.com

Application Worksheet (Normal Condition)

Reference/Quote: Weston 10-21-02 East Sparg

AMBIENT CONDITIONS:

Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Ambient Temperature:	70 Fahrenheit

APPLICATION REQUIREMENTS:

Gas;	AIR	Gas Properties:	
Molecular Weight:	28.966		
Cp:	0.241	Duty Cycle:	more than 4 hours
K Value (Cp/Cv):	1.398	Relief Pressure:	11 PSIG
Inlet Temperature:	70 Fahrenheit		
Inlet Volume:	25.11 ICFM		
Standard Volume:	25 SCFM		
Mass Flow:	112.5 lbs./hr		
Inlet Pressure:	14.63 PSIA (includes 0.066 PSI filter and/or silencer loss)		
Discharge Pressure:	10.01 PSIG (includes 0.009 PSI silencer loss)		

MODEL SELECTED FOR THE APPLICATION:

Model Number:	COMPETITOR PLUS 2002-21T2
Materials of Construction	Iron (standard)
Flow Direction	Horizontal Flow
Connection Size	1 NPT Inlet 1 NPT Discharge
Seal Type:	Lip
Lubrication:	Splash/Grease
Rotative Speed:	3192 RPM (60.51 % of Max)
Gear Tip Velocity:	2089 ft/min
Discharge Temperature:	217.9 Fahrenheit
Discharge Temperature @ Relief:	241.1 Fahrenheit
Discharge Volumetric Flow:	19.02 CFM
Required Input Power:	2.531 BHP
Required Input Power @ Relief:	2.754 BHP
Estimated Blower Noise:	84.0 dB(A) at 1 meter, open field
Noise Level Based On:	Inlet filter,inlet silencer and discharge silencer

SELECTED BLOWER OPTIONS:
Horizontal Flow
Top Drive

TESTING
Standard Mechanical Integrity Test

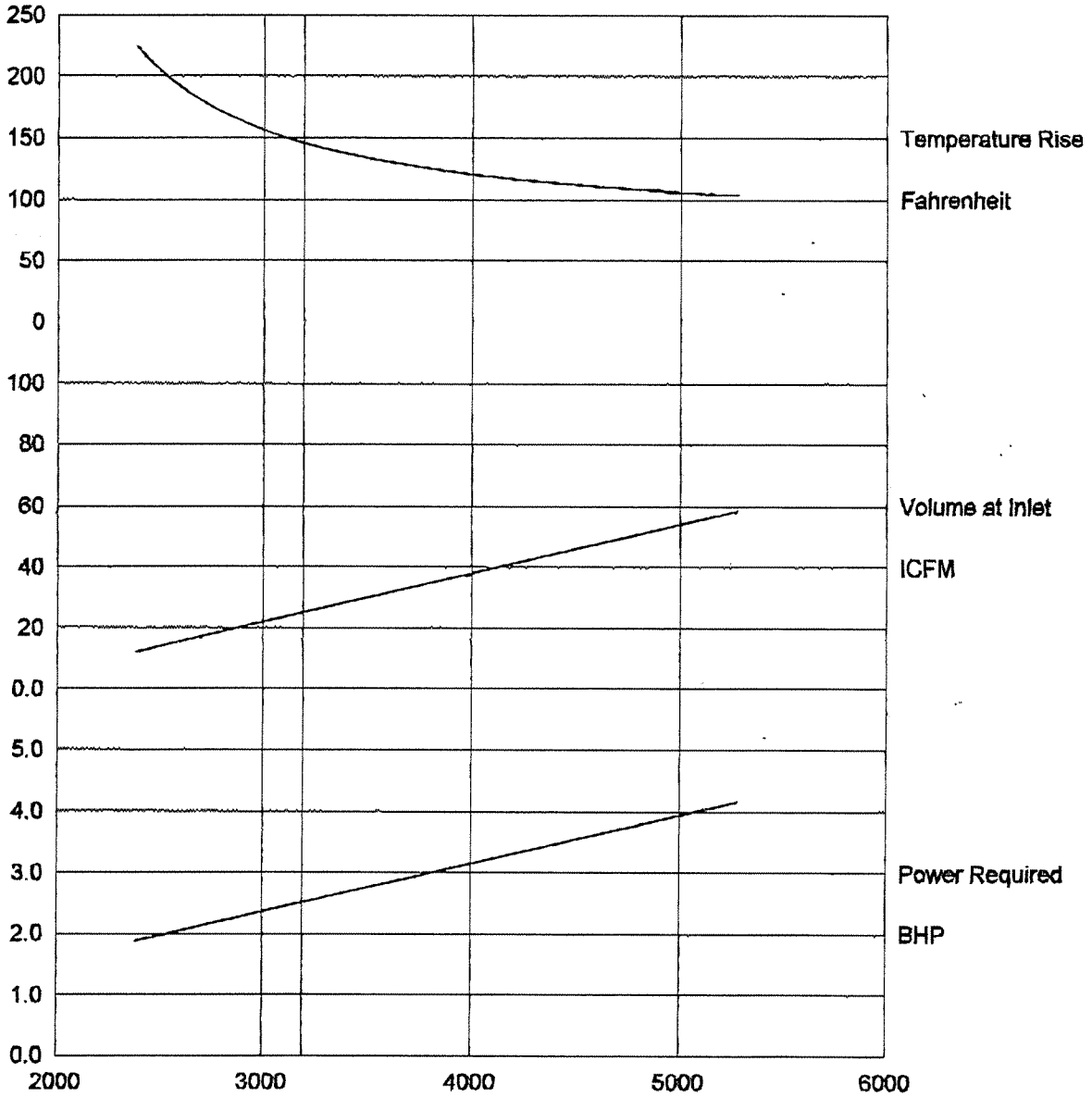
TUTHILL
Vacuum & Blower Systems

Date: 10/24/2002

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-693
Fax: (417) 865-2950
blowerxpert@tuthill.com

Normal Condition Performance Curve for 2002-21T2

Reference/Quote: Weston 10-21-02 East Spa



Performance Curve Based Upon The Conditions Of:

Displacement	0.016 CFR
Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Gas:	AIR
Inlet Temperature	70 Fahrenheit
Molecular Weight	28.966
K Value	1.398
Inlet Pressure	14.63 PSIA (includes 0.066 PSI filter and/or silencer loss)
Discharge Pressure	10.01 PSIG (includes 0.009 PSI silencer loss)

TUTHILL
Vacuum & Blower Systems

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-693
Fax: (417) 865-2950
blowerxpert@tuthill.com

Application Worksheet (Normal Condition)

Reference/Quote: Weston 10-21-02 West S

AMBIENT CONDITIONS:

Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Ambient Temperature:	70 Fahrenheit

APPLICATION REQUIREMENTS:

Gas:	AIR	Gas Properties:	
Molecular Weight:	28.966		
Cp:	0.241	Duty Cycle:	more than 4 hours
K Value (Cp/Cv):	1.398	Relief Vacuum:	10 in. Hg vac
Inlet Temperature:	70 Fahrenheit		
Inlet Volume:	349.1 ICFM		
Standard Volume:	240 SCFM		
Mass Flow:	1080 lbs./hr		
Inlet Pressure:	9.356 in. Hg vac (includes -0.356 in. Hg filter and/or silencer loss)		
Discharge Pressure:	1.58 PSIG (includes 0.080 PSI silencer loss)		

MODEL SELECTED FOR THE APPLICATION:

Model Number:	ACOUSTICAIR 4112-81L3
Materials of Construction	Iron (standard)
Flow Direction	Vertical Flow
Connection Size	4 Flange Inlet 4 Flange Discharge
Seal Type:	Single Envelope Gastight
Lubrication:	Splash
Rotative Speed:	2439 RPM (67.76 % of Max)
Gear Tip Velocity:	2554 ft/min
Discharge Temperature:	200.8 Fahrenheit
Discharge Temperature @ Relief:	222.6 Fahrenheit
Discharge Volumetric Flow:	270.2 CFM
Required Input Power:	15.37 BHP
Required Input Power @ Relief:	16.43 BHP
Estimated Blower Noise:	85.2 dB(A) at 1 meter, open field
Noise Level Based On:	Inlet filter,inlet silencer and discharge silencer

SELECTED BLOWER OPTIONS:
Standard Viton O-Rings in Mechanical Seals

TESTING
Standard Mechanical Integrity Test

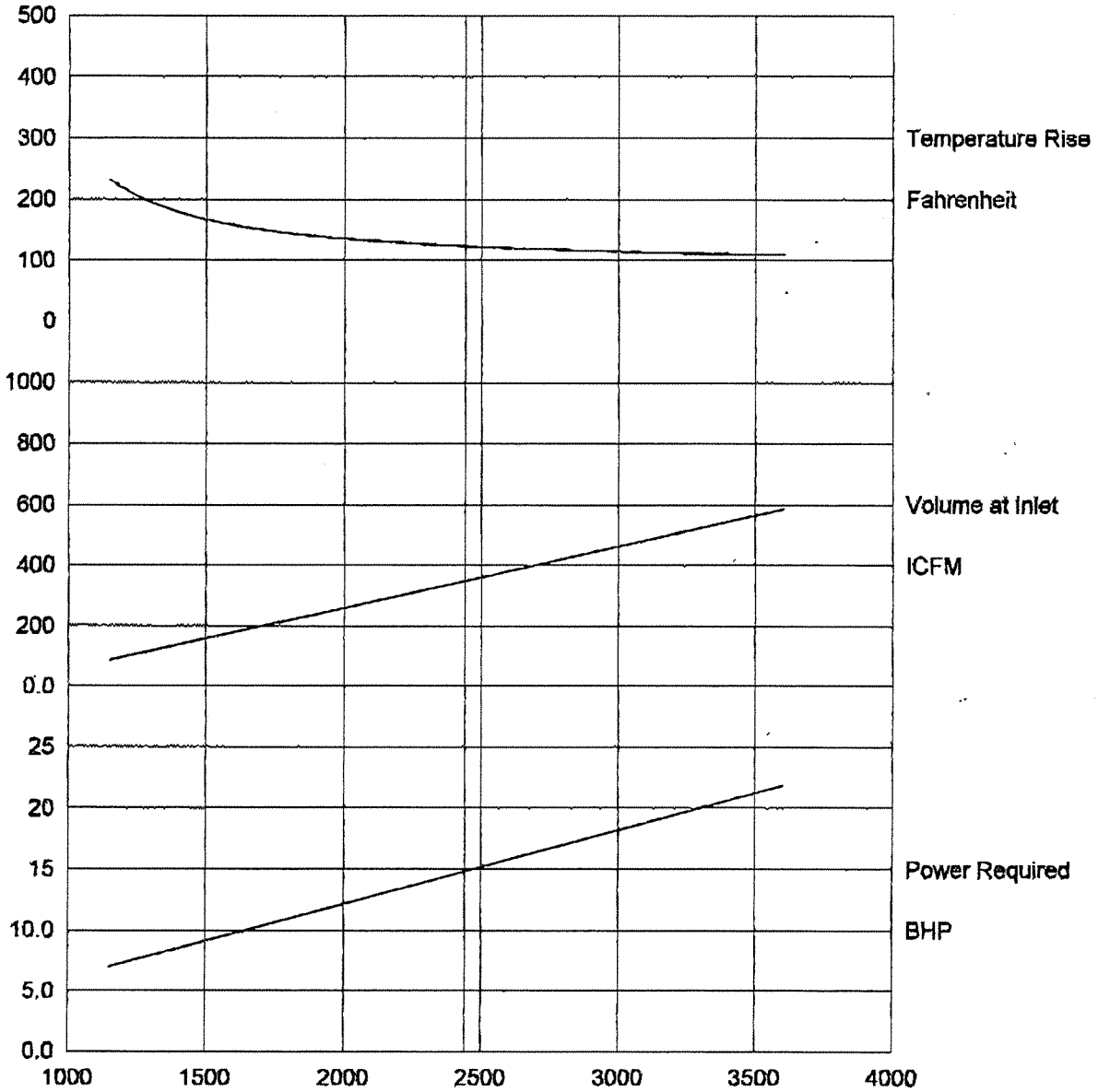
TUTHILL
Vacuum & Blower Systems

Date: 10/22/2002

Factory Offices
Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel: (417) 865-8715 Toll Free: (800) 825-693
Fax: (417) 865-2950
blowerxpert@tuthill.com

Normal Condition Performance Curve for 4112-81L3

Reference/Quote: Weston 10-21-02 West S



Performance Curve Based Upon The Conditions Of:

Displacement	0.203 CFR
Atmospheric Pressure:	14.7 PSIA
Elevation:	0 Feet
Gas:	AIR
Inlet Temperature	70 Fahrenheit
Molecular Weight	28.966
K Value	1.398
Inlet Pressure	9.356 in. Hg vac
Discharge Pressure	1.58 PSIG (includes 0.080 PSI silencer loss)

HEAT EXCHANGERS

North Area SVE

Xchanger, Inc. **Rating for Model AA-1000 ref #67045**

Engineer: Aaron Groh

Prepared for: October 22, 2002

J.E. Gasho & Associates, Inc.
Jim Gasho Jr.
PH: 610-692-5650, FAX: 610-692-5837

PERFORMANCE	**PROCESS AIR**	**AMBIENT AIR**
Fluid Circulated	Air	Air
Volumetric Flow Rate	540 Std. ft^3/min	3,687 Std. ft^3/min
Total Fluid Entering	2,430 lb/hr	16,594 lb/hr
Liquid		
Vapor		
Non-Condensibles	2,430 lb/hr	16,594 lb/hr
Vaporized or (Cond.)		
Temperature In	218 °F	100 °F
Temperature Out	107 °F	116 °F
Inlet Pressure (Absolute)	15.200 lb/in²	14.340 lb/in²
Velocity (Standard)	1,471 ft/min	871 ft/min
Pressure Loss	3.2 in. water	0.4 in. water
Fouling Factor	0.0001 ft²-°F-hr/BTU	0.0001 ft²-°F-hr/BTU

Total Heat Exchanged: 64,950 BTU/hr

PROPERTIES		
Thermal Conductivity	0.017 BTU/hr-ft-°F	0.016 BTU/hr-ft-°F
Specific Heat	0.240 BTU/lb-°F	0.240 BTU/lb-°F
Viscosity	0.050 lb/ft-hr	0.047 lb/ft-hr
Density	0.066 lb/ft^3	0.068 lb/ft^3
Latent Heat of Vapor		

CONSTRUCTION		
Design Temperature	250 °F	Not Applicable
Design Pressure (Gauge)	35 lb/in²	Not Applicable
Test Pressure (Gauge)	40 lb/in²	Not Applicable
Cyclic Pressure	No	Not Applicable
Flow Direction	Right Hand Horizontal	Vertical Up
Coating	None	None

Plate-Fin Core	: Aluminum	Exhaust Hood	: Galvanized Steel
Fan Guard	: Coated Carbon Steel	Venturi Frame	: Coated Carbon Steel
Drawing Number	:	Weight	: 250 lb

CONNECTIONS

Process Inlet : 4 inch dia. tube stub
Process Outlet : 4 inch dia. tube stub
Instrument :

MECHANICAL EQUIPMENT			
Fan Diameter	: 24 inch	Motor	: 1.00 HP TEFC
Fan Qty/Speed	: 1 / 1725 RPM	Motor Qty/Speed	: 1 / 1725 RPM
Fan Type	: 4 Blade Carbon steel	Motor Electrical	: 208-230/460/3/60

NOTES

Approximate unit dimensions (inches): A = 35, B = 66, C = 36, D = 16
Construction material suitability must be determined by customer.
The process flow must be uniform, smooth and free of pulsation.
This unit is not designed for cycling process gas pressure.

Oct.24. 2002 11:12AM 610 6925837 J E GASHO & ASSOC No.7321 P. 13

East Area SVE

Xchanger, Inc. **Rating for Model AA-1000 ref #67046**

Engineer: Aaron Groh

Prepared for: October 22, 2002

J.E. Gasho & Associates, Inc.
Jim Gasho Jr.
PH: 610-692-5650, FAX: 610-692-5837

PERFORMANCE	**PROCESS AIR**	**AMBIENT AIR**
Fluid Circulated	Air	Air
Volumetric Flow Rate	360 Std. ft^3/min	3,719 Std. ft^3/min
Total Fluid Entering	1,620 lb/hr	16,737 lb/hr
Liquid		
Vapor		
Non-Condensibles	1,620 lb/hr	16,737 lb/hr
Vaporized or (Cond.)		
Temperature In	223 °F	100 °F
Temperature Out	101 °F	112 °F
Inlet Pressure (Absolute)	15.200 lb/in²	14.340 lb/in²
Velocity (Standard)	980 ft/min	879 ft/min
Pressure Loss	1.9 in. water	0.4 in. water
Fouling Factor	0.0001 ft²-°F-hr/BTU	0.0001 ft²-°F-hr/BTU

Total Heat Exchanged: 47,245 BTU/hr

PROPERTIES		
Thermal Conductivity	0.017 BTU/hr-ft-°F	0.016 BTU/hr-ft-°F
Specific Heat	0.240 BTU/lb-°F	0.240 BTU/lb-°F
Viscosity	0.050 lb/ft-hr	0.046 lb/ft-hr
Density	0.066 lb/ft^3	0.069 lb/ft^3
Latent Heat of Vapor		

CONSTRUCTION		
Design Temperature	250 °F	Not Applicable
Design Pressure (Gauge)	35 lb/in²	Not Applicable
Test Pressure (Gauge)	40 lb/in²	Not Applicable
Cyclic Pressure	No	Not Applicable
Flow Direction	Right Hand Horizontal	Vertical Up
Coating	None	None

Plate-Fin Core	: Aluminum	Exhaust Hood	: Galvanized Steel
Fan Guard	: Coated Carbon Steel	Venturi Frame	: Coated Carbon Steel
Drawing Number	:	Weight	: 250 lb

CONNECTIONS

Process Inlet : 4 inch dia. tube stub
Process Outlet : 4 inch dia. tube stub
Instrument :

MECHANICAL EQUIPMENT			
Fan Diameter	: 24 inch	Motor	: 1.00 HP TEFC
Fan Qty/Speed	: 1 / 1725 RPM	Motor Qty/Speed	: 1 / 1725 RPM
Fan Type	: 4 Blade Carbon steel	Motor Electrical	: 208-230/460/3/60

NOTES

Approximate unit dimensions (inches): A = 35, B = 66, C = 36, D = 16
Construction material suitability must be determined by customer.
The process flow must be uniform, smooth and free of pulsation.
This unit is not designed for cycling process gas pressure.

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East Area - Sparge Blower HEX

American Precision Industries, Air Technologies Division
274 Sandusky Road / Arcade, NY 14009 / (716) 496-5755 / Fax: (716) 496-5776

CUSTOMER JE Gasho & Associates
ADDRESS
PLANT LOCATION
SERVICE OF UNIT AfterCooler
CUSTOMER PART NO.

JOB NO. Weston Ohio
REFERENCE NO.
PROPOSAL NO. PH0210215
DATE 10/21/02

MODEL 761-03011H

PERFORMANCE

		INSIDE AIR	OUTSIDE AIR
FLUID CIRCULATED		25 S CFM	540 CFM
FLOW RATE			
TOTAL FLUID ENTERING	Lbs/Hr	112.5	2748.9
NON-CONDENSIBLES	Lbs/Hr	112.5	2748.9
VAPOR	Lbs/Hr	0	0
LIQUID	Lbs/Hr	0	0
FLUID CONDENSED	Lbs/Hr	0	0
VISCOSITY @TEMP		.02 CPS @ 122 oF	.019 CPS @ 103 oF
SPECIFIC HEAT	BTU/Lbm-F	.241	.241
THERMAL CONDUCTIVITY	BTU/Hr-Ft-F	.016	.016
SPECIFIC GRAVITY or MOL. WEIGHT		28.966 (MW)	28.966 (MW)
TEMPERATURE IN	oF	239.0	100.0
TEMPERATURE OUT	oF	110.0	105.7
PRESSURE IN	psig	.5	0
FACE VELOCITY	Ft/Min	185.57	621.44
PRESSURE DROP	(CALC)	.5 psi	.28 In-H2O
FOULING RESISTANCE		.0005	.0005
SURFACE AREA	sq-Ft	16.71	41.84

HEAT EXCHANGED-TOTAL 3760.7 BTU/Hr | TRANSFER RATE 13.19 BTU/Hr-Ft2-F
-SENSIBLE 3760.7 BTU/Hr | MTD CORRECTED 17.06 oF
-LATENT 0 BTU/Hr | EXCHANGER EFFECTIVENESS 99.92 %
N.T.U. 8.1391 | Cmin/Cmax .041

CONSTRUCTION

	OSF	TRI
FIN TYPE		
FIN HEIGHT xFINS/Inch	.125 x 12	.375 x 12
NUMBER OF FLOW PASSAGES	22	23
FIN MATERIAL	ALUMINUM	ALUMINUM
FIN THICKNESS	.01 In	.006 In
PARTING SHEET THICKNESS	.024 In	N / A In
DESIGN PRESSURE	400 PSIG	20 PSIG
DESIGN TEMPERATURE	250 oF	250 oF
TEST PRESSURE	535 PSIG	N / A

CORE DIMENSIONS: NO-FLOW HEIGHT- 12.563 WIDTH- 12.5 DEPTH- 2.25
HEADER CONNECTIONS: INLET- 1" NP OUTLET- 1" NPT

MECHANICAL EQUIPMENT

FAN MFR AIR TURBINE PROPELLER
NO. FANS 1 HP/FAN
FAN DIA. 10 NO. BLADES 4
BLADE MATL. STEEL BLADE PITCH
RPM 1725 DRIVE DIRECT

MOTOR MFR. GENERAL ELECTRIC
NO. MOTORS 1 HP/MOTOR 1/4
RPM 1725
VOLTS/CYCLES/PHASES 230-460/60/3
ENCLOSURE TEFC

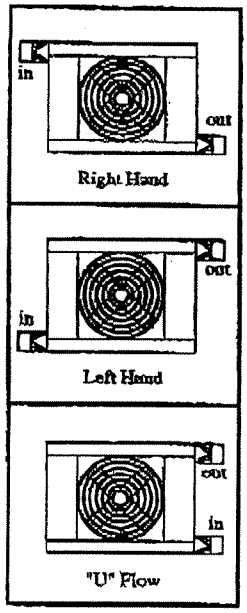
NOTES

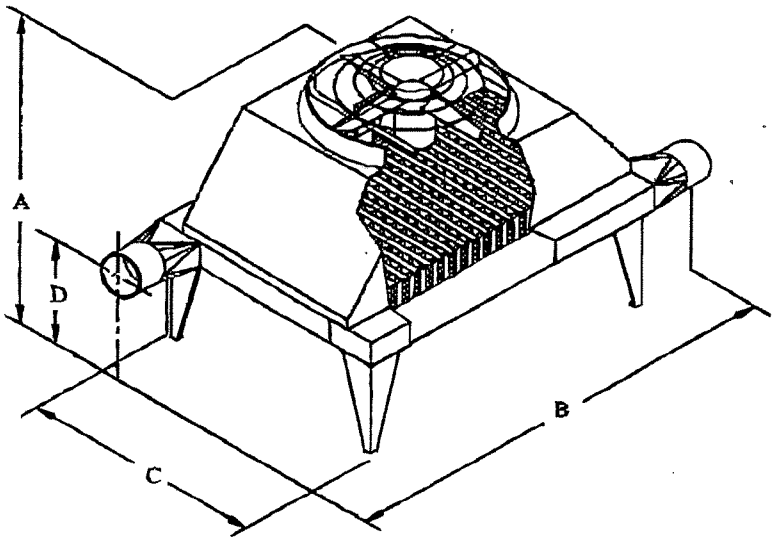
EXTERNAL FLUID MEASURED CONDITIONS: 100.0 F, 0% RH, 14.457 psia

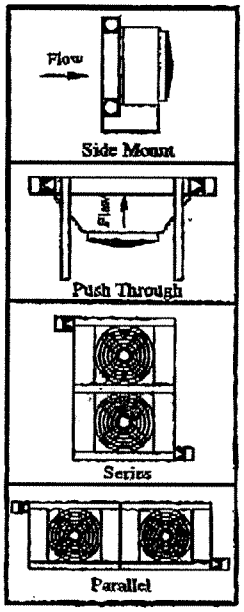
Xchanger, Inc.

AA Series Heat Exchanger

AA Series exchangers cool low pressure air streams using fan-drafted ambient air. Air flows to 3,500 CFM from vacuum to 75 PSI can be cooled near ambient, with under 0.2 PSI pressure loss. AA Series exchangers are ideal for installation outdoors where cooling water is unavailable or undesirable due to freezing temperatures. Indoor installations should be well ventilated. The process air should be filtered and pulsating flow, such as that produced by rotary lobe blowers, should be dampened by a chambered silencer prior to entering the heat exchanger.







See line #54 of data sheet for approximate dimensions

Std. Lead Time: 6 Weeks

Expedited Shipping Schedule (If Available)	
Working Days *	AA Series & Cores
5	20%
10	10%
15	5%
20	2.5%
30	---

* After Drawing Approval

Add 5 days to schedule for epoxy phenolic coating.

Design Options:

Connection types: tube, pipe, flange, NPT, ferrule, etc
Materials of construction:
- Core: aluminum (others available with our LC series)
- Propeller, venturi and shroud: painted or galvanized steel, aluminum, stainless steel
- Motors: any available

Epoxy phenolic coating for corrosion protection of the core
Units can be built to required dimensions
Multiple cores combined together to make a single unit

Accessories: (Prices Subject To Change)

Instrument Coupling:	$ 55
Thermometer: (In Coupling)	$ 88
Differential Pressure Gauge:	$ 280
Service side filters	Ask
Others available upon request	

X13F01

1401 S. 7th St • Hopkins, MN 55343 • Ph:952.933.2559 • Fax:952.933.5647• www.xchanger.com

We also offer water cooled exchangers

Oct.24. 2002 11:13AM 610 6925837 J E GASHO & ASSOC No.7321 P. 16

CARBON UNITS

Calgon Carbon Corporation EB-1027-05/97

Equipment Bulletin

High Flow VentSorb Emission Control Unit

Description

Calgon Carbon Corporation's High Flow VentSorb (HFVS) emission control units were developed to utilize granular activated carbon to treat air/vapor containing VOC emissions from a variety of applications at industrial, commercial, or remedial sites.

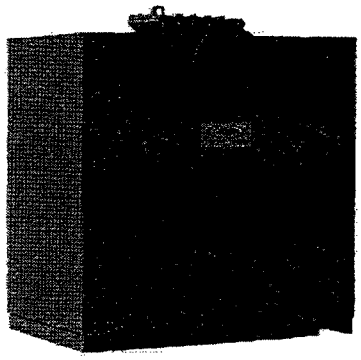
There are four sizes available to treat airflows up to 3,000 cfm. These units are designed to allow selection of the optimum size to economically solve air treatment needs. The units are constructed with features that allow for ease of installation and operation.

The HFVS units are available in four sizes: 500 cfm, 1,000 cfm, 2,000 cfm and 3,000 cfm. The units are constructed of carbon steel with an internal epoxy lining and external coating.

Specification Standard Features

Vessel Material:	Carbon Steel
Vessel Lining:	Epoxy
Vessel Exterior:	Epoxy
Manway:	One (1) 20" diameter manway on top of the unit for GAC loading with Buna-N Gasket
Temperature Rating:	Maximum continuous operating temperature 140°F, with excursions to 200°F.
Pressure Rating:	3 psig
Vacuum Rating:	HFVS not rated for vacuum
Underdrain Style:	False Bottom
Drain:	$^1/_2$" Plugged Drain Coupling
Connection:	Flanged Inlet/Outlet Nozzles, drilled to ANSI 150 lb. pattern

Model	Maximum Air Flow Capacity cfm	Carbon Capacity pounds	Shipping Weight pounds
HFVS 500	500	500	1,100
HFVS 1000	1,000	1,000	2,000
HFVS 2000	2,000	2,000	3,700
HFVS 3000	3,000	3,000	5,500



Features and Benefits

Easy to Install

The HFVS is fitted with supports for ease of off-loading and positioning near the emission source using a fork truck.

Ready to Use

The units are delivered pre-loaded with GAC to minimize labor costs for set-up.

Optimum Design

The HFVS units are designed to optimize the amount of GAC installed in each unit taking into consideration the air flow requirements, available space and low system pressure drop.

Reusable Unit

When the GAC in the HFVS is spent and no can longer remove additional contaminants, it can easily be removed and refilled using the large 20" diameter manway installed on top of the unit.

Corrosion Resistant

The HFVS units are constructed of epoxy lined and painted carbon steel with a stainless steel bed support.

Effective Treatment of a Wide Variety of Contaminants

The HFVS can be provided with different types of GAC to provide treatment tailored to specific requirements.

Continuous Treatment

The HFVS unit works 24 hours per day to remove contaminants from air emissions regardless of fluctuations of air flow rate.

Flexibility to Meet a Variety of Needs

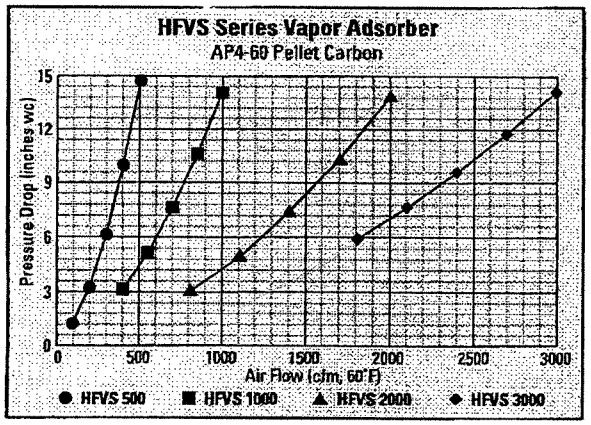
The HFVS unit requires relatively little space. When necessary, the units can be installed side by side then piped for either series or parallel operation.

HFVS Installation

The HFVS units are shipped ready for installation. The unit can be moved using a fork truck and should be placed as near as possible to the emission source. After placement, remove the manway and check that the GAC is level (it may shift during shipment).

Connect from the emission source to bottom inlet connection on the HFVS using flexible hose, lightweight ductwork or pipe. Connect the discharge piping to the upper outlet connection.

The maximum recommended airflow is listed in the Specification Section of this bulletin. If higher flows are required, another unit should be added in parallel. The unit operates upflow, so high airflow rates above the maximum listed could expand the bed, causing premature breakthrough.



Pressure drop is based on using AP4-60 type carbon, which is a 4mm pellet. For other types of GAC, the pressure drop should be adjusted. For BPL4x10, multiply the pressure drop by 1.5. For VPR 4x10, multiply the pressure drop by 1.6.

Special Considerations

When the HFVS is used to control vapors from an organic solvent storage tank, the following precautions are recommended:

- A safety relief valve must be provided. This protects the storage tank should the HFVS become plugged or blocked in any fashion. Such a vent would open in this emergency situation, thereby relieving pressure.
- Under appropriate conditions, a flame arrestor and/or a backflow preventer must be installed as shown. This prevents backflow of air when the storage tank is empty.
- Pre-wetting the carbon helps dissipate excessive heat that may be caused by high organic concentrations (>0.5 to 1 Vol%).

When the HFVS is used to control organic emissions from air strippers or other high moisture sources, Calgon Carbon recommends that humidity in the air stream be reduced to less than 50%. Lower humidity optimizes adsorption capacity of the GAC. Also, a condensate drain trap should be installed on the drain connection to carry away any moisture that collects in the unit.

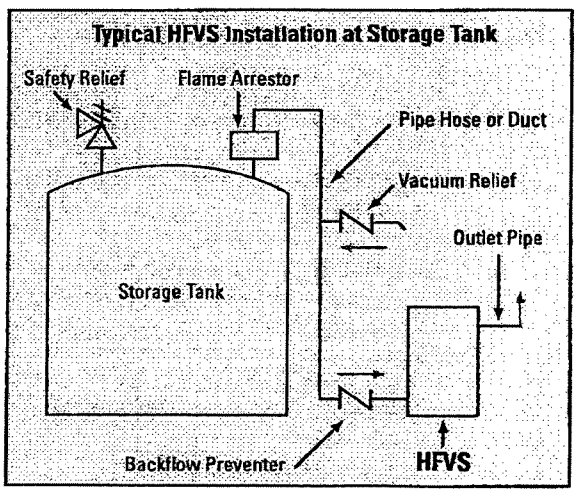
Carbon Bed Life Estimate

For an estimate of carbon bed life, contact your local sales representative.

Carbon Replacement

When it has been determined that the carbon is spent (no longer adsorbs the target compounds), it is time to replace the carbon. Follow these steps to replace the spent carbon with fresh carbon.

1. Isolate the HFVS by either disconnecting the ductwork or by closing the inlet and outlet valves.
2. Open the manway and remove the spent carbon by vacuuming or by bucket to appropriate storage containers. If the unit must be entered to access spent carbon, take the appropriate safety measures for confined space entry. Refer to the safety message on this bulletin.
3. When all the spent carbon is removed, inspect the bed support for signs of damage.
4. Refill the unit with fresh carbon by loading it through the manway. After each bag is loaded to the vessel, level the surface using a rake or similar device.
5. Replace the manway and reconnect the ductwork.



Spent Carbon Return

Spent carbon can be retuned to Calgon Carbon for reactivation after the carbon aceptance procedure is complete. Contact your local representative for detailed instructions and to arrange for carbon acceptance testing. It is recommended that you start the carbon acceptance testing before change-out to minimize handling of the spent carbon. This should be done when ordering fresh carbon.

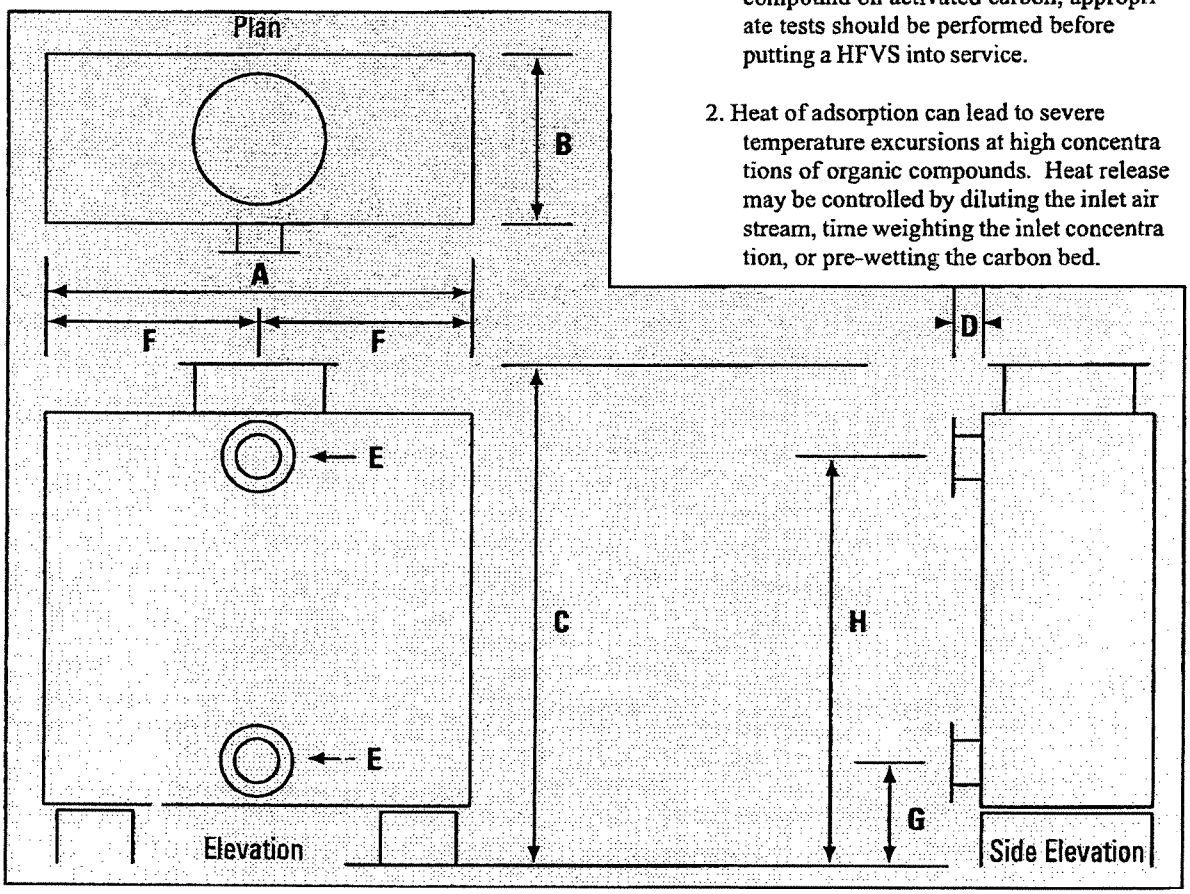
Saftey Considerations

While complying with recommended installation instructions, operators should also be aware of these additional heat related safety considerations:

1. When GAC adsorbs some types of chemical compounds, such as those in the ketone, aldehyde, organic acid or organic sulfur families, the chemical may react on the carbon surface, causing severe exotherm or temperature excursions. If you are unaware or unsure of the reaction of an organic compound on activated carbon, appropri ate tests should be performed before putting a HFVS into service.

2. Heat of adsorption can lead to severe temperature excursions at high concentra tions of organic compounds. Heat release may be controlled by diluting the inlet air stream, time weighting the inlet concentra tion, or pre-wetting the carbon bed.

HFVS Dimensional Data



HFVS Dimensional Data

Model	Width A	Depth B	Canister Height C	Nozzle Length D	Inlet/Outlet Nozzle Diameter E	Nozzle Position F	Inlet Nozzle Height G	Outlet Nozzle Height H
HFVS 500	36"	24"	66"	3"	6"	18"	10"	57 5/16"
HFVS 1000	45"	39"	68"	3"	8"	22 1/2"	10"	58 5/16"
HFVS 2000	72"	48"	76"	3"	12"	36"	11 1/2"	64 3/8"
HFVS 3000	72"	72"	79"	3"	14"	36"	12 1/2"	67"

Warranty

Calgon Carbon Corporation (Seller) warrants that the High Flow Ventsorb sold shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. This warranty does not apply to problems associated with normal wear and tear, improper maintenance, negligence, misuse, or the failure to operate in strict accordance with the operating and maintenance plan provided. For those items provided by, but not directly manufactured by the Seller, the manufacturer's warranty shall apply provided warranty coverage exceeds that which is provided by the Seller. All other warranties, either express or implied, are hereby disclaimed including, but not limited to, the warranty of merchantability and fitness for a particular purpose.

Seller warrants that any/all activated carbon provided hereunder shall conform to the specifications for such grade as published from time to time by the Seller. There are no warranties made with regard to the activated carbon or equipment to be sold hereunder other than those contained in this paragraph or stated elsewhere in the proposal. All other warranties, either express or implied, are hereby disclaimed including, but not limited to, the warranty of merchantability and fitness for a particular purpose.

This warranty is limited to the replacement and/or repair by the Seller of any part, parts or material, which in the Seller's determination are defective. This warranty does not cover any charges by the Buyer for replacement of parts, adjustments or repairs, or any other work unless such charges shall be assumed or authorized in advance in writing by the Seller.

Limitation of Liability

Seller's liability and the Purchaser's exclusive remedy for any cause of action arising out of purchase and use of the High Flow Ventsorb including, but not limited to, breach of warranty, negligence and/or indemnification, is expressly limited to a maximum of the purchase price of the High Flow Ventsorb as sold. All claims of whatsoever nature shall be deemed waived unless made in writing within forty-five (45) days of the occurrence giving rise to the claim. In no event shall the Seller for any reason or pursuant to any provision of these warranties be liable for incidental or consequential damages, or damages in excess of the purchase price of the High Flow Ventsorb, nor shall the Seller be liable for loss of profits or fines imposed by Governmental agencies.

Safety Message

Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low oxygen spaces should be followed, including all Federal and State requirements. For additional details, see Calgon Carbon Bulletin AB-006-08/94: Safety Considerations with Activated Carbon

Calgon Carbon Corporation's activated carbon products and services are continuously being improved and changes may have taken place since this publications was issued.

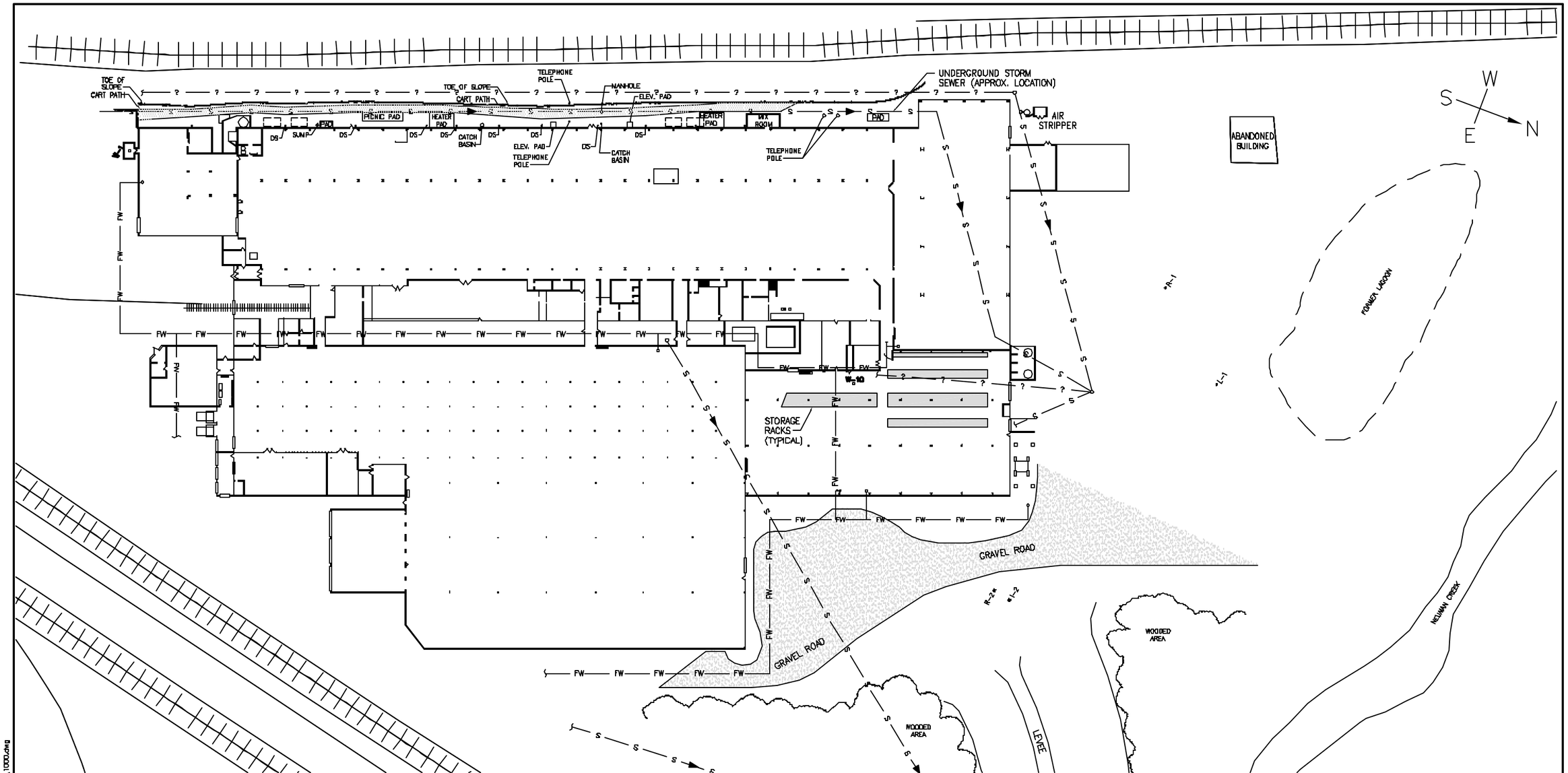
CALGON
CALGON CARBON CORPORATION

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA 15230

Chemviron Carbon
Zoning Industriel C
B-7181 Feluy, Belgium

Chemviron Carbon

APPENDIX C
DESIGN DRAWINGS



LEGEND

—FW—	EXISTING FIRE WATER PIPING	DS	EXISTING DOWN SPOUT
++++++++	EXISTING RAIL LINE	R-2 ■	EXISTING GROUNDWATER MONITOR WELL
—S—	EXISTING STORM SEWER PIPING	W-10 □	EXISTING RECOVERY WELL
—?—	POSSIBLE PIPING		

40 0 40 80

SCALE 1"=40'-0"

FILE NO. G:\ACAD\PROJ\02994D020080005 EXCO\1000.dwg

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

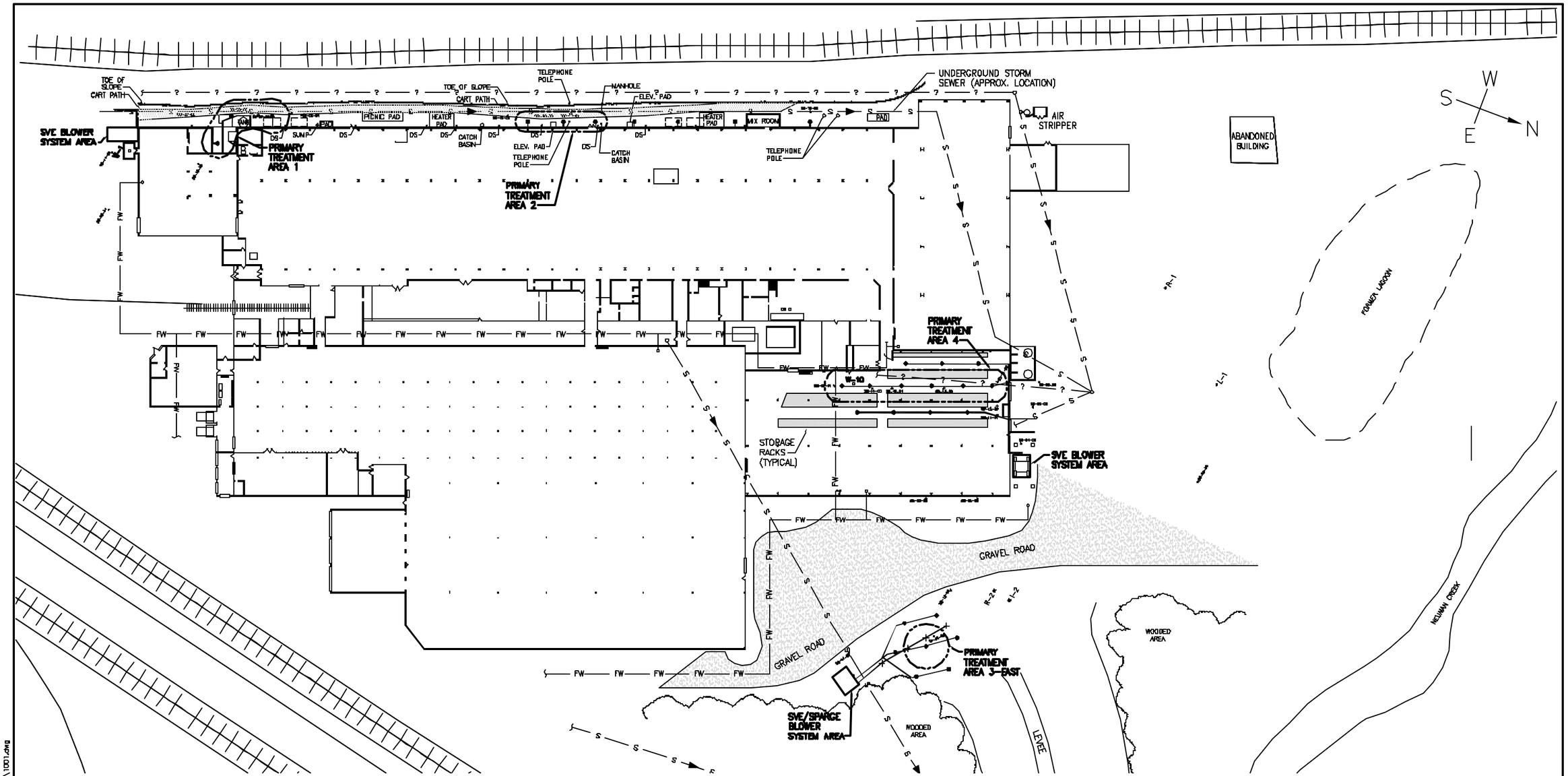
WORLD KITCHEN, INC.
MASSILLON, OHIO FACILITY
Prepared for Wyeth, Florham Park, New Jersey

WESTON SOLUTIONS
WEST CHESTER PENNSYLVANIA

CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG.			
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

FACILITY PLOT PLAN

DRAWN	DATE	DWG. NO.	REV. NO.
A.B.H.	11/4/02	100	
SCALE 1"=40'-0"	W.O. NO. 02994D020090005	SHT. X OF X	



NOTE:

SVE PIPING AND VENT LOCATIONS ARE APPROXIMATE AND WILL BE ADJUSTED TO ACCOMMODATE FIELD CONDITIONS.

LEGEND

—FW—	EXISTING FIRE WATER PIPING
++++++++	EXISTING RAIL LINE
—S—	EXISTING STORM SEWER PIPING
—?—	POSSIBLE PIPING
———	SVE PIPING
DS	EXISTING DOWN SPOUT
R-2	EXISTING GROUNDWATER MONITOR WELL
W-10	EXISTING RECOVERY WELL
92-B5-D5	SOIL BORING LOCATION
+	PLANNED SPARGE WELL
	PLANNED SOIL VAPOR EXTRACTION VENT

40 0 40 80

SCALE 1"=40'-0"

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
A	11/4/02		SHIFTED PRIMARY TREATMENT AREA 2 TEN FEET SOUTH.				

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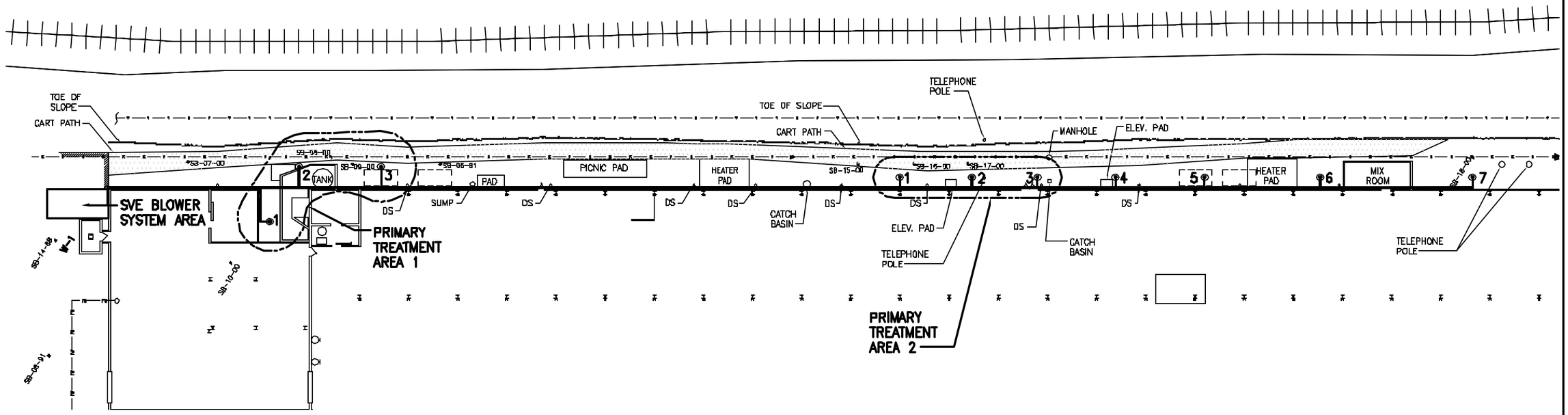
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

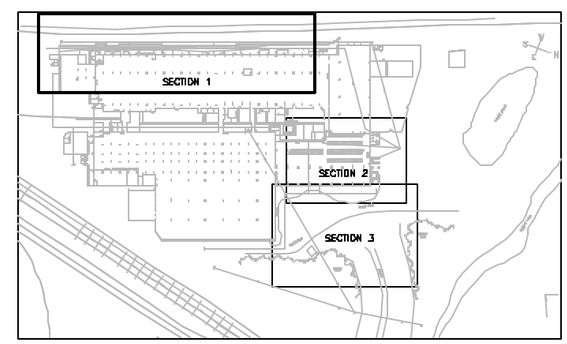
SVE AND SPARGE GENERAL PIPING LAYOUT

DRAWN	DATE	DWG. NO.	REV. NO.
A.B.H.	11/4/02	101	A
SCALE 1"=40'-0"	W.O. NO. 02994-D02009D005	SHT. X OF X	

FILE NO. G:\ACADPROJ\02994D02009D005 EXCO\101.dwg



PARTIAL PLAN – SECTION 1



KEY PLAN
N.T.S.

NOTE:
SVE PIPING AND VENT LOCATIONS ARE APPROXIMATE AND WILL BE ADJUSTED TO ACCOMMODATE FIELD CONDITIONS.

LEGEND

—FW—	EXISTING FIRE WATER PIPING
++++++++	EXISTING RAIL LINE
—S—	EXISTING STORM SEWER PIPING
—?—	POSSIBLE PIPING
———	SVE PIPING
DS ○	EXISTING DOWN SPOUT
R-2 ■	EXISTING GROUNDWATER MONITOR WELL
W-10 □	EXISTING RECOVERY WELL
SB-05-00 ▪	SOIL BORING LOCATION
●	PLANNED SOIL VAPOR EXTRACTION VENT

20 0 20 40
SCALE 1"=20'-0"

NO.	DATE	APPR.	REVISION
A	11/4/02		SHIFTED PRIMARY TREATMENT AREA 2 TEN FEET SOUTH.

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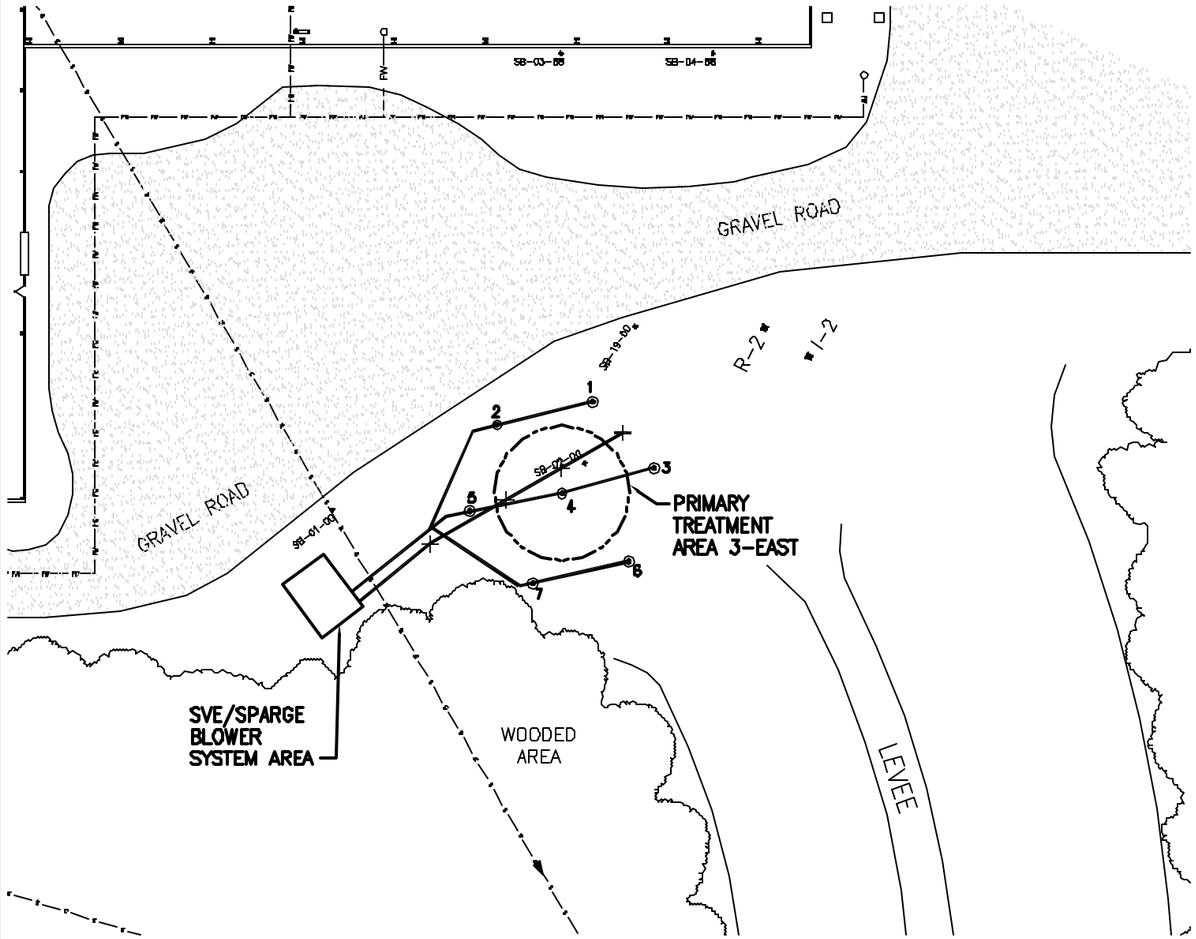
CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG.			
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

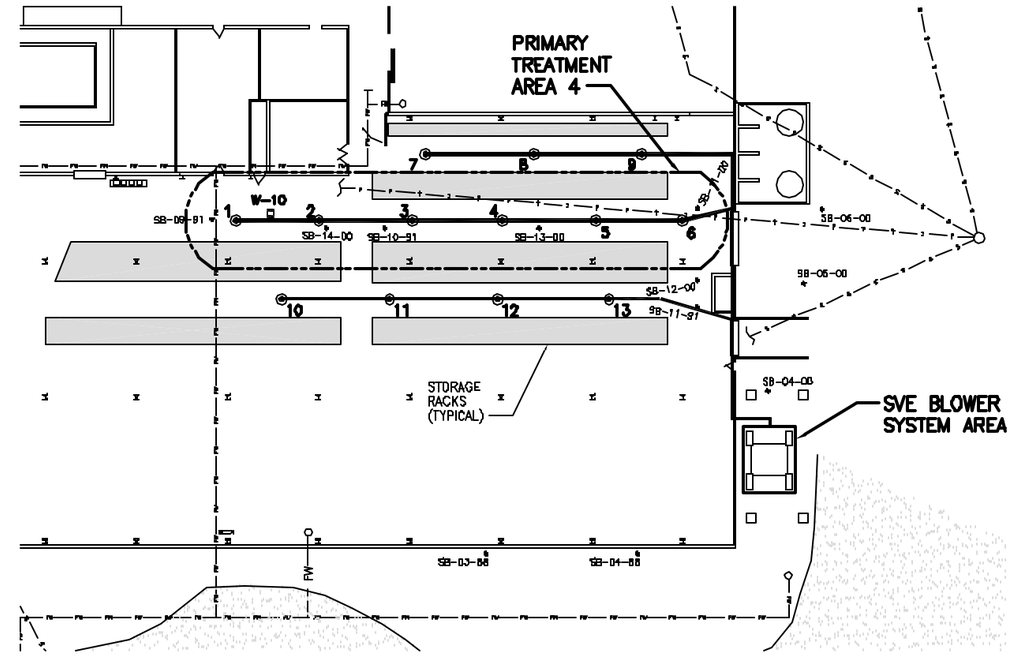
SVE SYSTEM LAYOUT
AREA 1 & AREA 2

DRAWN	DATE	DWG. NO.	REV. NO.
A.B.H.	11/4/02	102	A
SCALE 1"=20'-0"	W.O. NO. 02994D020090005	SHT. X OF X	

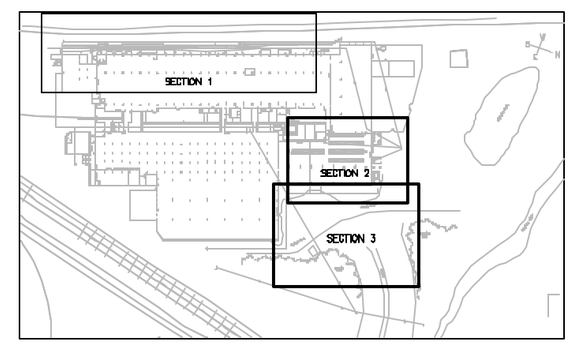
FILE NO. G:\ACADPROJ\02994D020090005 EXCO\102.dwg



PARTIAL PLAN – SECTION 3



PARTIAL PLAN – SECTION 2



KEY PLAN
N.T.S.

NOTE:
SVE AND VENT PIPING LOCATIONS ARE APPROXIMATE AND WILL BE ADJUSTED TO ACCOMMODATE FIELD CONDITIONS.

LEGEND

—FW—	EXISTING FIRE WATER PIPING	R-2	EXISTING GROUNDWATER MONITOR WELL
++++++++	EXISTING RAIL LINE	W-10	EXISTING RECOVERY WELL
—S—	EXISTING STORM SEWER PIPING	SB-03-88	SOIL BORING LOCATION
—?—	POSSIBLE PIPING	+	PLANNED SPARGE WELL
———	SVE PIPING	●	PLANNED SOIL VAPOR EXTRACTION VENT
DS	EXISTING DOWN SPOUT		

20 0 20 40
SCALE 1"=20'-0"

FILE NO. G:\ACADPROJ\02994002000900 EXCO\1003.dwg

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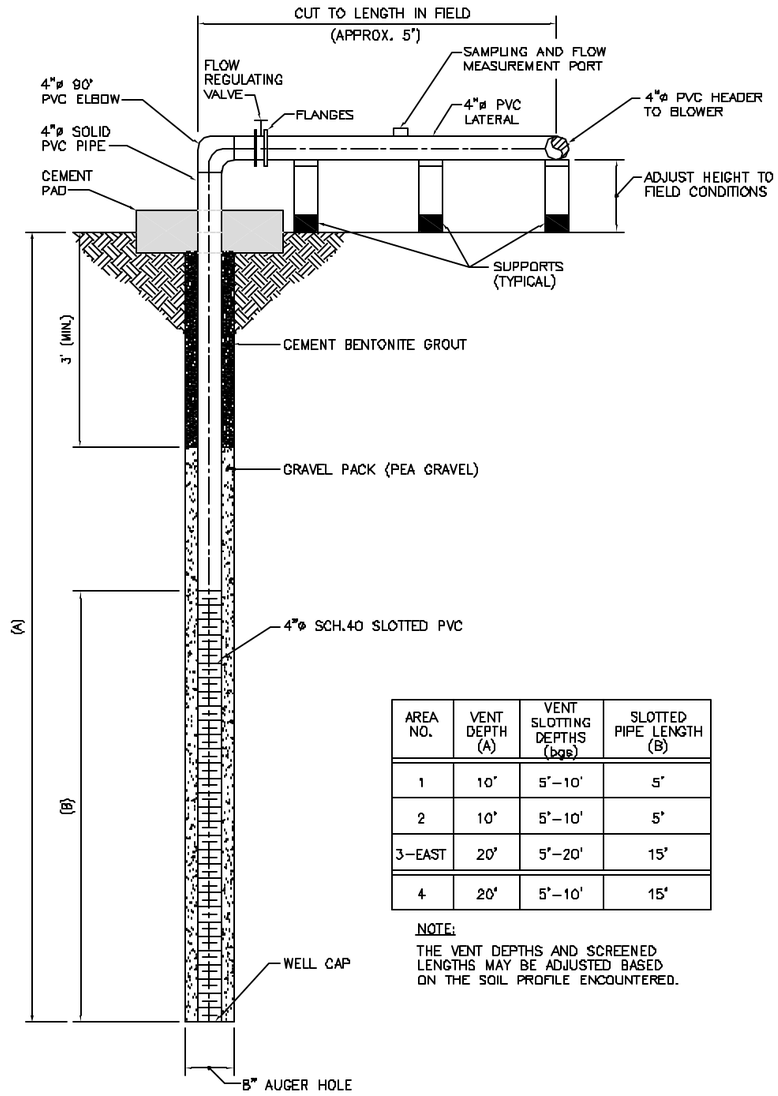
CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG.			
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

SVE AND SPARGE SYSTEM LAYOUT
AREA 3-EAST & AREA 4

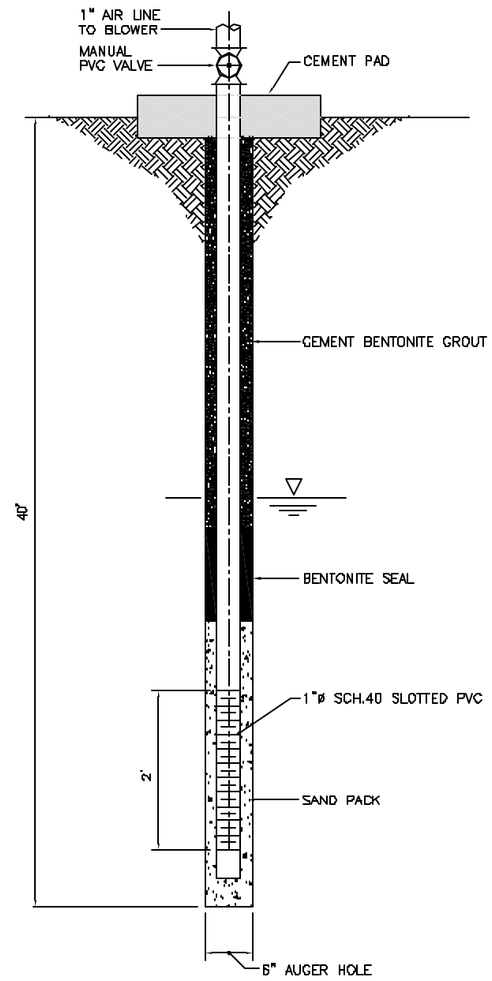
DRAWN	DATE	DWG. NO.	REV. NO.
A.B.H.	11/4/02	103	
SCALE 1"=20'-0"	W.O. NO. 02994D020090005	SHT. X OF X	



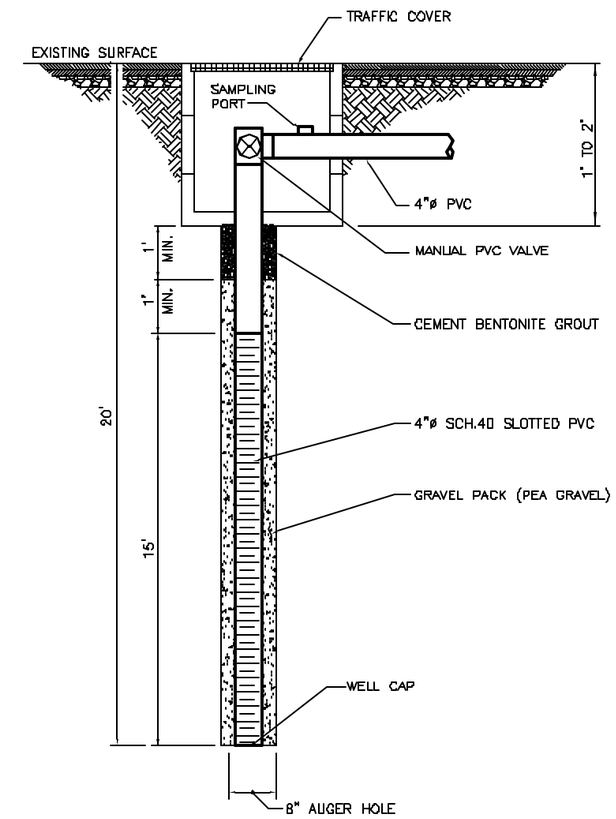
AREA NO.	VENT DEPTH (A)	VENT SLOTTING DEPTHS (bgs)	SLOTTED PIPE LENGTH (B)
1	10'	5'–10'	5'
2	10'	5'–10'	5'
3–EAST	20'	5'–20'	15'
4	20'	5'–10'	15'

NOTE:
THE VENT DEPTHS AND SCREENED LENGTHS MAY BE ADJUSTED BASED ON THE SOIL PROFILE ENCOUNTERED.

SOIL VAPOR EXTRACTION VENT (TYPICAL)
(AREAS 1, 2, & 3–EAST)
N.T.S.



AIR SPARGE WELL (TYPICAL)
(AREA 3–EAST)
N.T.S.



SOIL VAPOR EXTRACTION VENT (TYPICAL)
(AREA 4)
N.T.S.

FILE NO. G:\ACADPROJ\02994D020080005 EXCO\104.dwg

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

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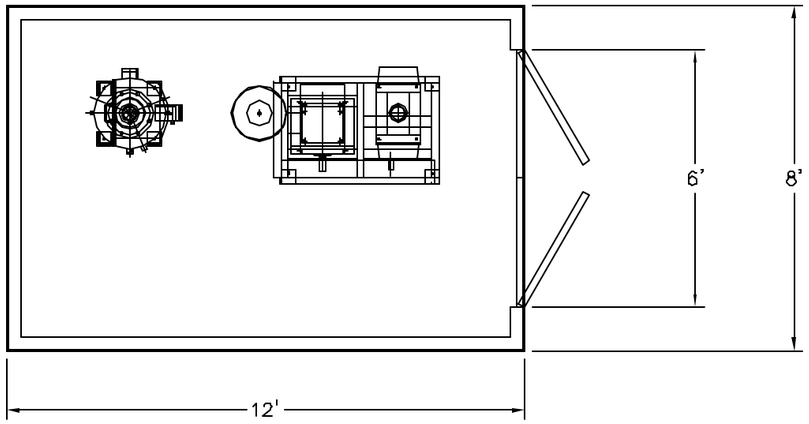
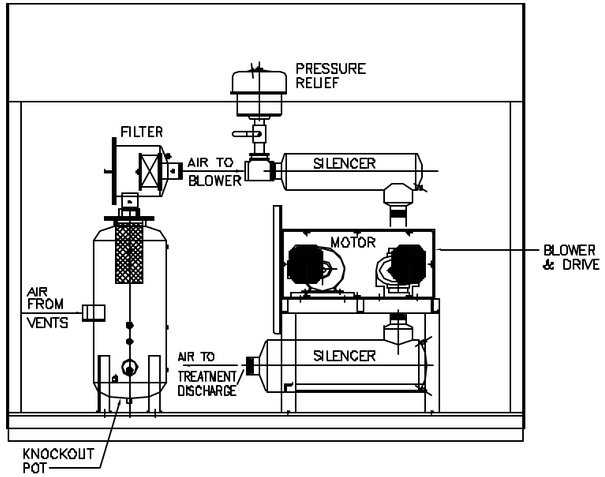
CHECKED	DATE	CLIENT APPROVALS	DATE
DES. ENG.			
PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

SVE VENT AND SPARGE WELL DETAILS

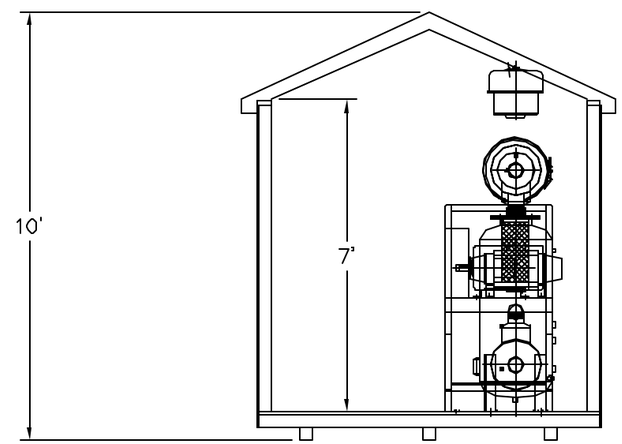
DRAWN	DATE	DWG. NO.	REV. NO.
A.B.H.	11/4/02	104	
SCALE	W.O. NO.	SHT. X OF X	
As shown	02994D020080005		



PLAN



ELEVATION



ELEVATION

NOTE:
DIMENSIONS ARE APPROXIMATE AND GIVEN FOR ILLUSTRATION. CARBON UNITS WILL BE PLACED OUTSIDE THE ENCLOSURE.

FILE NO. G:\ACADPROJ\02994002008000S EXCO\1005.dwg

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PROJ. ENG.			
PROJ. MGR.			
APPROVED			
APPROVED			

TYPICAL EQUIPMENT LAYOUT

DRAWN	DATE	DWG. NO.	REV. NO.
A.B.H.	11/4/02	105	
SCALE 1"=20'-0"	W.O. NO. 02994D020090005	SHT. X OF X	