SITE ASSESSMENT REPORT
FIRE TRAINING AREA
FOLLOW-UP REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Prepared for:

U.S. Army
Badger Army Ammunition Plant
2 Badger Road
Baraboo, Wisconsin 53913-5000

January 2004

Olin Corporation – Winchester Division
Badger Army Ammunition Plant, Baraboo, WI 53913-5000

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 CERTIFICATION PAGE

In accordance with NR 712.09, a registered professional engineer and a hydrogeologist from the State of Wisconsin certify this Site Assessment Report. The required certification statements are presented, and signed and sealed as follows:

Report prepared by:

"I, **Joel L. Janssen***, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03(1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."*

Joel L. Janssen, Hydrogeologist — 1/5/04

Signature and title **Date**

Report reviewed by:

"I, **John P. Hansen***, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."*

Manager Tech Services — 1/5/04

Signature and title **Date**

2.0 PROJECT LOCATION

The Fire Training and Practice Areas are located in the northwestern portion of the Badger Army Ammunition Plant (BAAAP), immediately south of Fire Station #1 (Badger Accounts #222 and 223) (refer to Figure 1).

3.0 PROJECT BACKGROUND

The January 1999 Environmental Baseline Survey (EBS), prepared by Plexus Scientific Corporation, mentioned the Fire Training Area in Section 1006A. The EBS classified Section 1006A as a Category 7 site because complete information on spills, accidents and potential environmental contamination was not available. The EBS referenced a document by A.T. Kearney (1987) stating that no documentation of previous studies for the Fire Training Area were found. Sampling was determined necessary by Olin Corporation (Olin) after a review of plant plans and aerial photographs (refer to Figures 2 3, and 4) identified the location of the Fire Training and Practice Areas.

Olin discovered a set of plans from 1971 for an addition to the existing Fire Station #1 (#223). The plans show a "new paved practice area" and an "existing fire fighting area" (see Figure 4). These two areas do match areas currently visible on the 2001 aerial photo (Figure 5). The "new paved practice area" was used between approximately 1971 and 1980. The "existing fire fighting area" is currently visible as a distressed, circular, gravelly area and a rectangular concrete slab.

4.0 SOIL GAS SURVEY

A total of nine EMFLUX® soil gas collectors were installed on November 6, 2003 and retrieved on December 1, 2003 in the Fire Training and Practice areas behind Badger Accounts #222 and 223. Refer to Appendix A for photographic documentation of sampling locations. Beacon Environmental Services, Inc. (Beacon) of Bel Air, Maryland, provided the collectors.

The passive soil gas survey consisted of sampling and analyzing the gases within the pore space in unsaturated soil above the water table. If present within the soil and/or groundwater, volatile organic compounds (VOCs) volatilize readily into the air-filled soil pore spaces, where they are available for migration within the soil vapor (gas) phase. The subsequent movement of soil gas in the subsurface is a complex function of the characteristics of the target VOC and the subsurface geologic materials, as well as time-variant gradients of pressure, temperature and contaminant concentration in the subsurface. Groundwater within the area investigated is approximately 90 feet bgs.

For most unsaturated geologic materials and physical settings, the ambient conditions allow VOCs within the vapor phase to migrate several tens to hundreds of feet from their

source location(s). Consequently, soil gas concentrations at a particular sampling location represent spatially and temporally averaged values. The advantage of using shallow soil gas reconnaissance methods are that the samples need not be collected from directly within the contaminant source itself.

Passive soil surveys integrate concentrations over a longer period of time in order to over come problems associated with time-varying barometric pressure conditions. Passive soil gas surveys use a small absorbent tube buried at a shallow depth.

Attached in Appendix B is a copy of the EMFLUX® technology description.

4.1 Installation of Soil Gas Collectors

Soil gas collectors SG-60 through SG-68 were placed in the Fire Training and Practice Areas. Refer to Figure 5 for the layout of the soil gas collector locations relative to nearby buildings and site features.

The collectors were each lowered into a 2.5-inch diameter borehole created with a bobcat-mounted Geoprobe. The boreholes were drilled to a depth of 4 feet.

The collectors were secured with a metal wire attached to a survey stake. At the surface, tin foil and native soil were used to plug the hole and prevent the soil gas from escaping to the atmosphere. Attached in Appendix C is a copy of the EMFLUX® field kit guide that outlines standard field procedures for deploying EMFLUX® collectors. This guide includes a diagram showing proper installation procedures for an EMFLUX® collector in soil and/or concrete/asphalt.

4.2 Soil Gas Survey Laboratory Methods

A total of 30 collectors (28 soil gas samples, one duplicate field sample, and one trip blank) were analyzed by Beacon. Only nine of the collectors were analyzed from the Fire Training and Practice areas. The samples were analyzed using gas chromatography (GC), in accordance with the Environmental Protection Agency (EPA) method 8021 (modified). A total of 12 VOCs were screened using EPA method 8021.

Appendix D contains a copy of Beacon Report No. 1617, which includes the following: field deployment report, Beacon laboratory report, chain-of-custody form, list of VOC compounds analyzed, quality control methods, and laboratory procedures.

Nanograms (ng) are the units of measurement used to quantify the EMFLUX® soil gas results. There are not regulatory standards for soil gas concentrations expressed in ng. The soil gas concentrations are relative to the actual subsurface concentrations found in

the soil and groundwater. Beacon recommends that a ratio be established between the soil gas measurements and actual soil and/or groundwater concentrations.

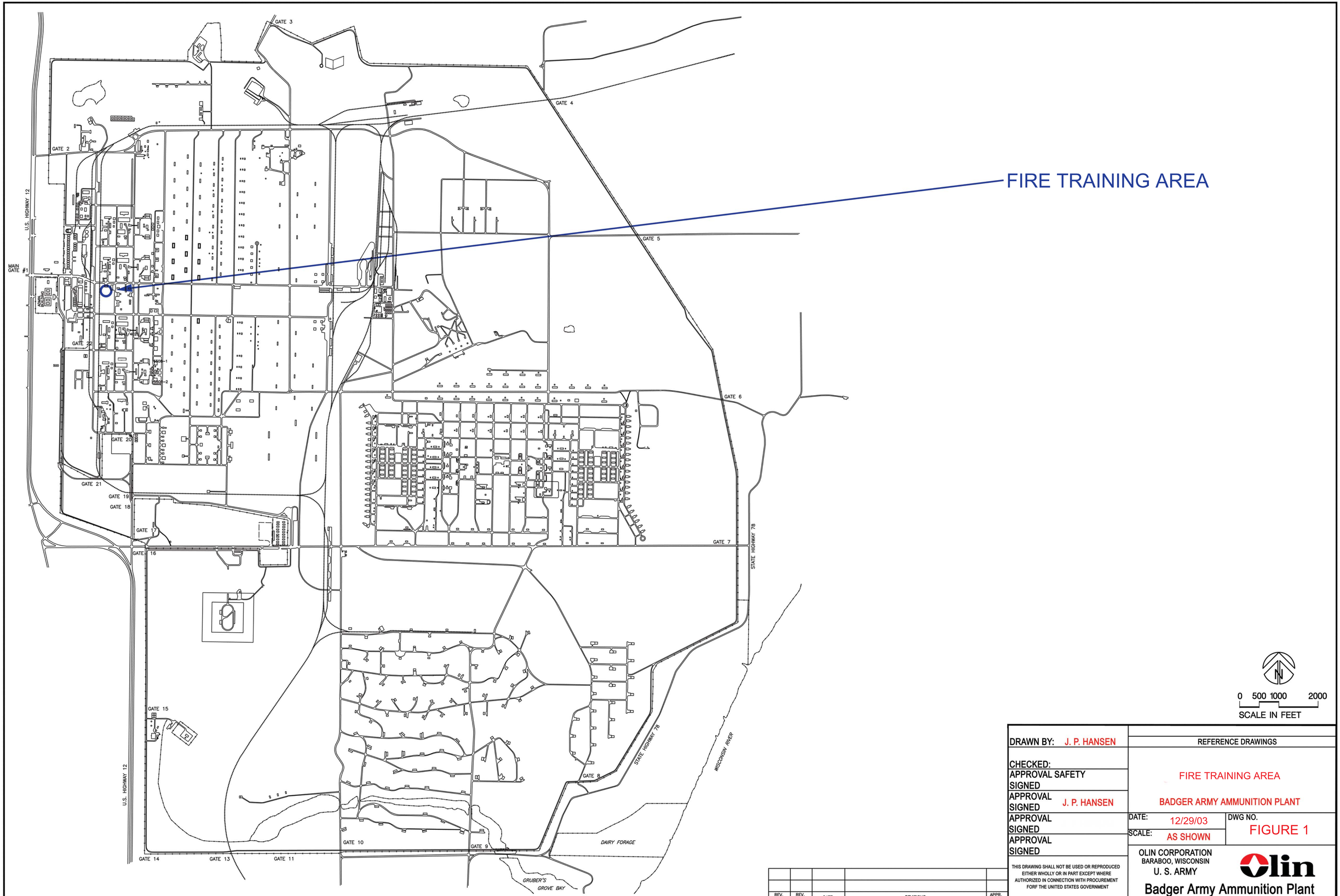
5.0 SOIL GAS SURVEY RESULTS

No VOCs were detected in soil gas collectors SG-60 through SG-68. Refer to Attachment 1 of Appendix D for a table of laboratory data.

6.0 CONCLUSIONS

The scope of this soil gas survey was limited to potential VOC contamination. Soil gas collectors were placed in worst-case spill locations and no VOC contamination was detected. Based on these results, Olin does not recommend further investigation of the Fire Training Area.

Figures



REV. NO.	REV. BY	DATE	REVISIONS	APPR. BY

DRAWN BY: J. P. HANSEN

CHECKED:

APPROVAL SAFETY SIGNED

APPROVAL SIGNED J. P. HANSEN

APPROVAL SIGNED

APPROVAL SIGNED

REFERENCE DRAWINGS

FIRE TRAINING AREA

BADGER ARMY AMMUNITION PLANT

DATE: 12/29/03

SCALE: AS SHOWN

DWG NO. FIGURE 1

OLIN CORPORATION
BARABOO, WISCONSIN
U. S. ARMY

Olin

Badger Army Ammunition Plant

Figure 2: Fire Training Area/ Lab Area (1968)

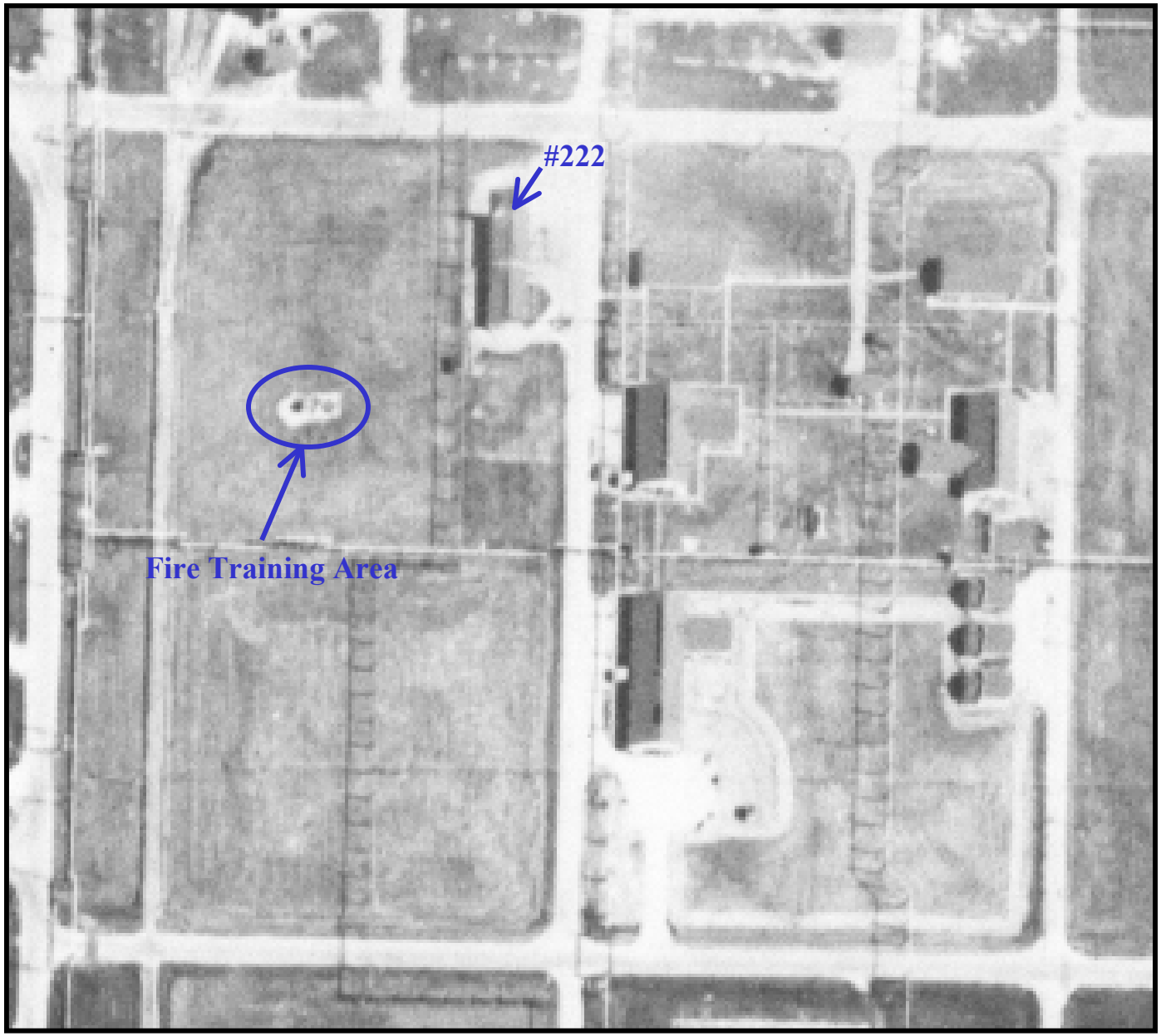
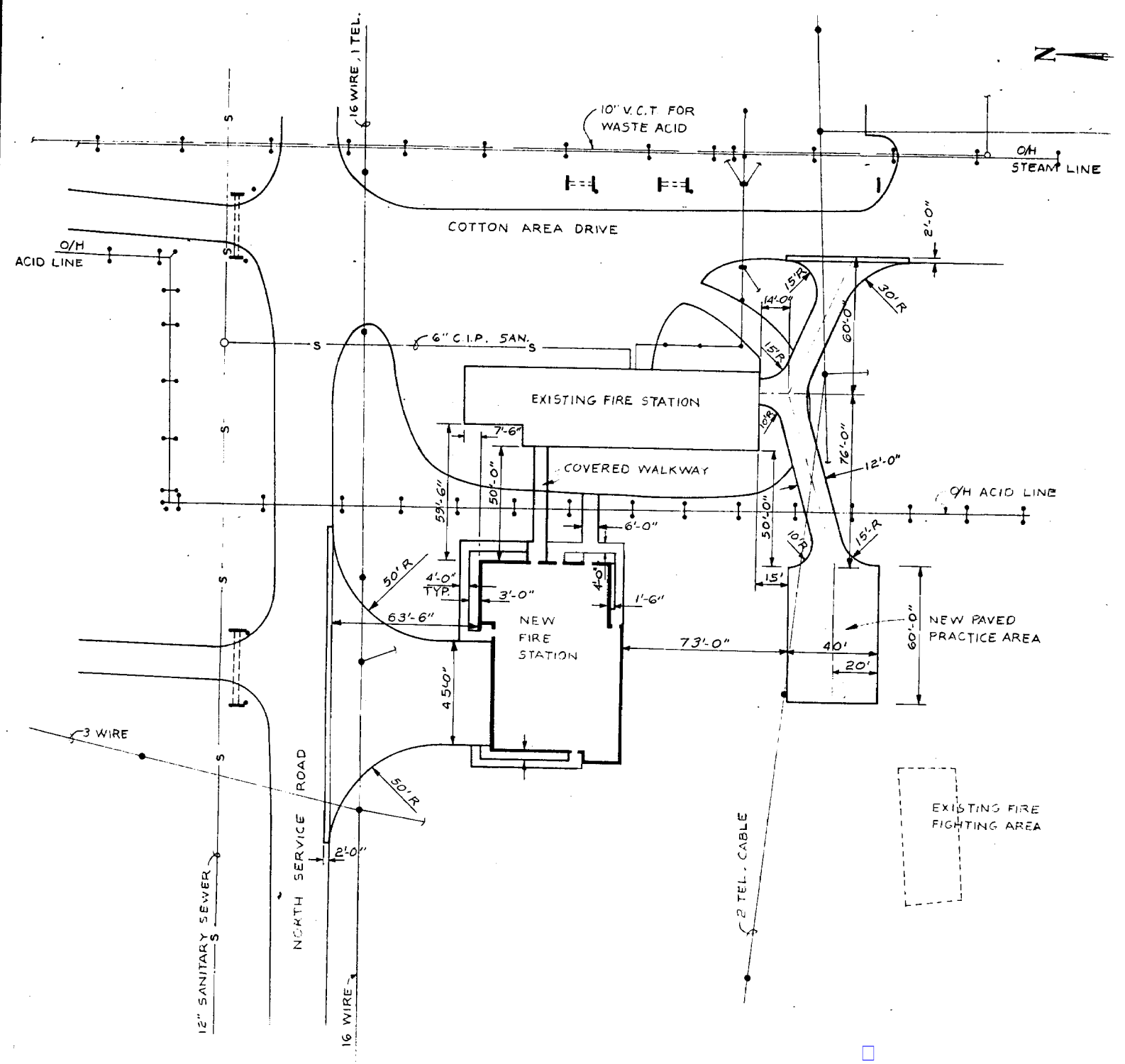


Figure 3: Fire Training Area/ Lab Area (1986)



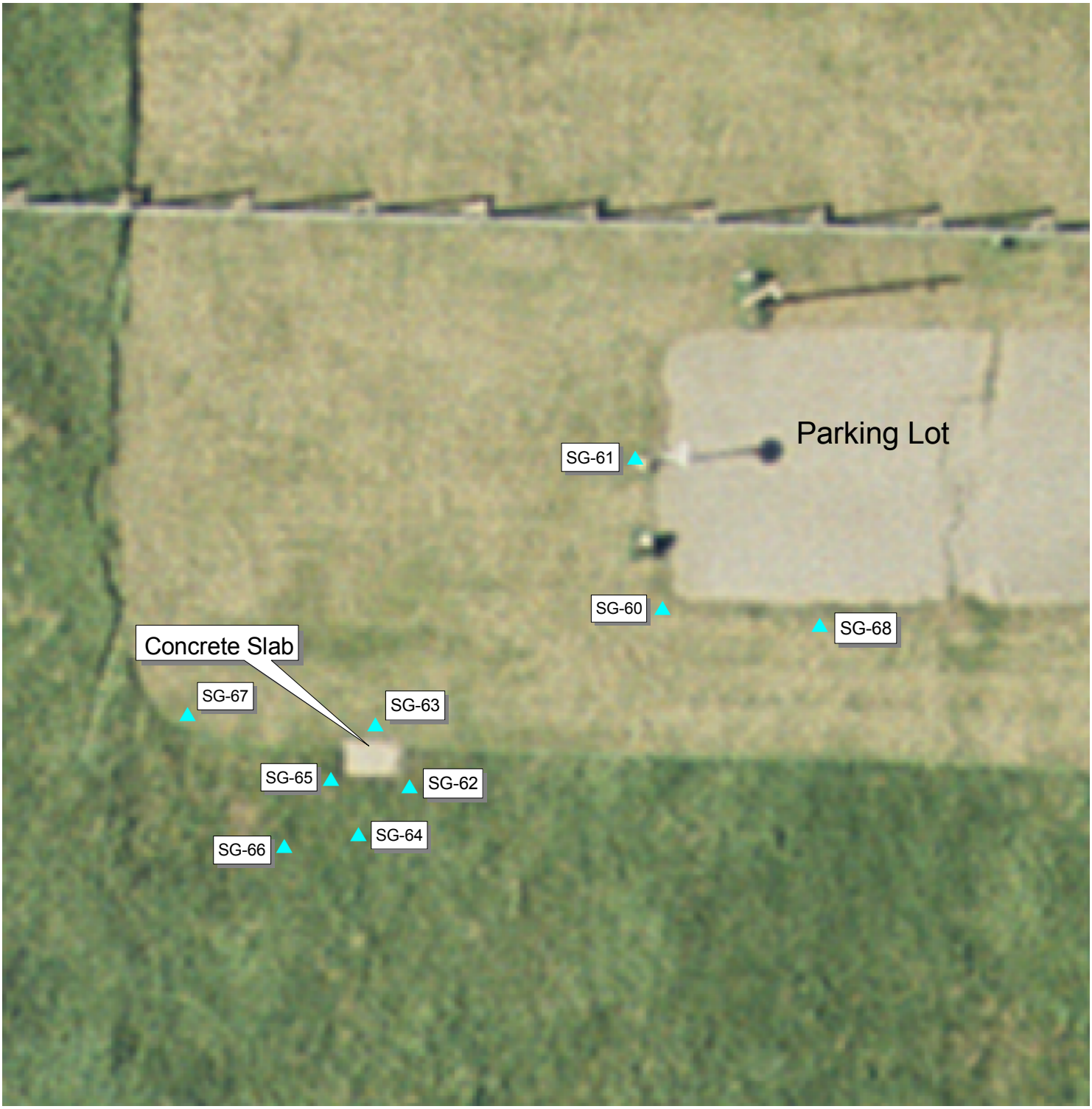
SITE PLAN

SCALE: 1 INCH = 30 FEET

30' 0 30'

FIGURE 4

FIRE STATION SITE PLAN



FIRE TRAINING AREA
FIGURE 5

Olin
GIS/Mapping Services

N

Aerial was flown on 5/16/01

▲ Soil Gas Sampling Location

9 0 9 18 Feet

Appendix A

Site Photographs

View, facing southwest, of the Fire Training Area.

View, facing west, of the former Fire Training Area.

View, facing east, of the former Fire Training Area.

Distressed, circular, gravelly area just southwest of the rectangular concrete slab.

View, facing northeast, of the practice area (currently used as a parking lot) and the former Fire Training Area.

View of the practice area, currently being used as a parking lot.

Appendix B

EMFLUX® Technology Description

EMFLUX® Technology Description

Background

Passive sampling techniques rely on diffusion and adsorption and can be used to sample for VOCs. The developers of passive soil gas samplers claim that the passive samplers allow for equilibrium to develop between the soil gases and the sorbent over a period of several days to weeks. Further, the developers claim that exposure of the passive samplers to the soil gas over extended periods concentrates the mass of VOCs absorbed to the sampler; thereby enhancing contaminant detection sensitivity.

The EMFLUX® system is a passive soil gas sampling system developed by Quadrel. According to Quadrel, the EMFLUX® system is based on technology developed over the past 35 years, and was originally used in the minerals exploration industry to detect radon gas and locate uranium deposits. Beacon Environmental Services, Inc. is currently the only company which offers the EMFLUX® System.

The EMFLUX® system components consist of a sample cartridge and installation tools. The "system" also incorporates computer modeling to predict optimal sampling times for a specific geographic location and sample analyses, both provided by the developer. The EMFLUX® system uses a proprietary software package to predict periods of maximum soil gas emission for any location. This software package models the relationship between the gravitational phenomenon known as "earth tides" and orders-of-magnitude changes in the vertical velocities of gases moving through the earth's crust. The modeling of this relationship allows Quadrel to theoretically predict favorable (relatively high-vertical-velocity) periods for soil gas sampling. Knowing when these favorable periods occur may decrease the period of time the samplers must be left installed at a site; however, EMFLUX® surveys may be conducted at virtually any time.

Empirical and Theoretical Bases for EMFLUX® System

Quadrel's EMFLUX® technology is based on the existence of cyclical periods of favorable (high) and unfavorable (low) gas-migration velocities through the earth's crust and on the ability to predict the occurrence of those cycles consistently and reliably. The existence of order-of-magnitude cyclical changes in upward trace-gas velocity is predicated on empirical evidence: the utility of the EMFLUX® system rests on a theoretical connection between that empirical data and earth-tidal (gravitational) phenomena recorded by U.S. Geological Survey and National Aeronautics and Space Administration.

The relationship was developed in the early 1970s by Quadrel's Chief Scientist, George H. Milly, who holds doctorates in Geochemistry and Atmospheric Physics. Identification of this relationship grew out of Dr. Milly's search for the cause of observed cyclical variations in atmospheric concentrations of radon, which all but negated attempts to use

atmospheric radon as an indicator in uranium exploration. Previously recognized factors influencing vertical trace-gas migration through soils (such as temperature, barometric pressure, and moisture changes) failed to correlate with the recorded cyclical variations, and this divergence ultimately led to the discovery of relationships between gravitational phenomena and soil-gas migration rates. Subsequent development includes computerization of the algorithms used to predict favorable soil-gas sampling periods. EMFLUX® was first used in the 1970s to support uranium exploration programs and located more than 34 million pounds of uranium reserves.

Quadrel was founded in the late 1980s to commercialize applications of this fundamental technology in the field of environmental testing. It is Quadrel's belief now-given available data, field verifications of soil-gas-velocity predictions, and successes in governmental, industrial, and private projects-that the company's predictive earth-tide model has established itself as a practical method for identifying favorable emission flux periods at any point on the earth's surface. This capability has, in turn, spurred development of an environmental field sampling system that can take advantage of the phenomenon: the passive, noninvasive EMFLUX® Soil-Gas Investigation System.

In 1989, the EMFLUX® system was first formally evaluated on a (now closed) U.S. EPA test bed under the auspices of the National Environmental Technology Applications Center (NETAC). The objective of the test was to determine EMFLUX's® ability to detect and quantify the relative Source strength of various contaminants in ground water. NETAC reported a 0.91 correlation coefficient between EMFLUX® soil-gas data and groundwater contaminant concentrations and that EMFLUX® correctly identified the dominant contaminant, chloroform.

Appendix C

EMFLUX® Field Kit

BEACON'S

FIELD KIT GUIDE
for
EMFLUX® SOIL-GAS INVESTIGATIONS

[PLEASE READ ENTIRE GUIDE BEFORE STARTING SURVEY]

www.emflux.com

I. General Information

A. BEACON is furnishing this Kit to **Olin Corporation** (Olin) specifically for use on the **Laboratory Solvent Investigation at Badger Army Ammunition Plant in Wisconsin.** To obtain optimum results it is important that the collectors be deployed no later than **November 7, 2003,** and retrieved on **December 1, 2003**. The EMFLUX® predictive model has determined these specific timing parameters. If deployment of the devices is delayed, please contact us as soon as possible. BEACON's phone number is (800) 878-5510. [**Note**: To meet personal or work schedules, the collectors may be deployed days prior to and retrieved days following the specified dates.]

B. It is also essential that, prior to returning the Kit to BEACON, Olin seal the EMFLUX® sorbent cartridges in the Sampler Vials provided and return the vials and holders sealed in the inner and outer plastic component bags.

C. ***Before going to the field please*** inventory the contents of the Kit, checking them against the enclosed list to verify item counts and to become familiar with all components. (Because the components are thoroughly cleaned prior to shipment, the inventory should be conducted without opening the plastic bags.) Note that Trip Blanks are to remain sealed throughout the Survey.

D. BEACON requests that Olin sign and date the enclosed Chain-of-Custody Form immediately upon receipt of the Kit, fill out the Field Deployment Report during the course of the survey, and, after signing the release section of the Chain-of-Custody Form, return both documents to the company, together with a scaled Site Map showing precise sample locations.

E. Upon completion of the Survey, please pack the collectors, equipment, and requisite documentation in the original shipping container. Affix the provided custody seals on the shipping container, and call Federal Express (1-800-238-5355) for overnight shipment to:

Sample Receiving
Beacon Environmental Services, Inc.
323 Williams Street
Suite D
Bel Air, MD 21014
410-838-8780

NOTE: DO NOT PACK IN THE KIT STYRENE PEANUTS OR OTHER MATERIALS THAT COULD CONTAMINATE THE SAMPLES. PLEASE AVOID SMOKING WHILE HANDLING COLLECTORS.

II. Contents

A. This EMFLUX® Field Kit contains the components needed for a **28**-point soil-gas survey, plus sufficient additional cartridges for **1** trip blank (vial labeled **Trip-1**, not to be opened), and **1** extra collector for use in the event of breakage or accidental contamination. Assuming that instructions are followed, due care is exercised in QA/QC procedures, and timing schedules are observed, the Kit provides users with an extremely accurate and reliable soil-gas system. **Do not open bags until deployment.**

Code/Item		Quantity
(1)	EMFLUX® COLLECTORS	**29**
(2)	SAMPLING CAPS (in container)	**29**
(3)	CAP STORAGE CONTAINERS	**1**
(4)	WIRE CUTTERS	**1**
(5)	GAUZE CLOTHS	**25**
(6)	EXTRA WIRE	**1 Roll**

B. In addition to the materials found in the kit, field teams will need:

- NITRILE GLOVES
- CLEAN TOWEL
- HAMMER
- EQUIPMENT NECESSARY TO CREATE A 2”-DIAMETER HOLE
- PLIERS and TROWEL (to assist in retrieving Collectors)
- BALL-POINT PEN and CLIPBOARD
- PIN FLAGS, WOODEN STAKES, or OTHER LOCATION MARKERS
- BOX OF ALUMINUM FOIL

III. Instructions

A. GENERAL:

Deployment and retrieval of EMFLUX® Collectors requires only one person. Separate step-by-step procedures are detailed below for sampling through vegetation or bare soils. For ease during deployment and retrieval, remove the outer plastic bags surrounding the Collectors; however, rebag the Collectors between deployment and retrieval and before shipping the samples. **Keep exposure of sample cartridges to ambient air to a minimum.**

Note: Do not deploy collectors within 10 feet of a monitoring well, penetrometer, hydropunch shaft, or other intrusive sampling apparatus that potentially creates a preferential pathway for gases.

REMEMBER:

- **TRIP BLANKS ARE NOT TO BE OPENED.**

B. COLLECTOR DEPLOYMENT:

Vegetation or Bare Soils:

Note: Each Collector contains two adsorbent cartridges. BEACON will analyze one cartridge per Collector; however, the second cartridge in each Collector can be analyzed as a field sample duplicate. Olin will note at which locations, if any, duplicates are to be analyzed by writing separate entries corresponding to the sample location followed by the letter "D" (*i.e*, 3, 3-D, 4, 4-D) on the Chain-of-Custody Form. It is not necessary to alter the deployment pattern to have the duplicate samples analyzed. There is an additional per sample charge for analysis of any duplicates.

1. At each sample location, clear vegetation as necessary and create a two-inch diameter hole to the specified depth. Remove the probe from the hole and move the equipment away from the sample location before installing the Collector.

2. Remove one of the Collectors (a glass vial containing two ***hydrophobic*** adsorbent cartridges) and unwind the retrieval wire wrapped around it. Holding the capped end of the vial in one hand, pull the wire tight (to straighten it) with the other hand. Remove the solid cap on the Sampler Vial and replace it with a Sampling Cap (a one-hole cap with a screen meshing insert). Place the solid cap in the Field Kit.

3. Lower the Collector with the capped-end pointing down approximately 12 inches into the hole. If necessary, use the extra wire provided to suspend each collector to this depth. Firmly hold onto the retrieval wire so the collector does not fall into the hole. [Note: It is often helpful to stake the wire outside the hole so it will not fall in.] Next, take a wad of aluminum foil and ***tightly*** plug the top of the hole so that the foil rests approximately ½-inch below the ground surface with the wire extending out of the plugged hole. Once again, make sure the Collector is secure so it will not fall into the hole. Using the hammer, collapse the soils above the foil. **Coil the wire and lay it flat on the ground surface. [Note: Tying a ribbon of flagging tape around the coiled wire will make it easier to locate the Collector during retrieval.]** Place the solid cap in the Cap Storage Container. Place the solid cap in the Cap Storage Container.

4. Close the Field Kit, and on the Field Deployment Report record: (a) sample-point number; (b) date and time of emplacement (to nearest minute); and (c) other information deemed relevant (*e.g.*, unusual weather, ground conditions, or type of vegetation present). Be sure to mark the sample location and take detailed notes (*i.e.*, compass bearings and distances from fixed reference points).

5. Move to next location.

C. COLLECTOR RETRIEVAL:

Vegetation or Bare Soils:

1. At each sample point open the Field Kit within easy reach. Remove a square of gauze cloth and place it and a clean towel on the open Kit. Remove a solid cap from the Cap Storage Container and place it on the Kit, also.

2. While holding onto the retrieval wire, use a screwdriver or scratch awl to remove the aluminum foil plug. Next, pull the Collector out of the hole.

3. Holding the Collector upright, clean the sides of the vial with the clean towel (especially close to the Sampling Cap). Remove the Sampling Cap, cut the wire from the vial with the wire cutters, and clean the vial threads completely with the gauze cloth. [**Note**: Completely remove the wire to ensure the cap fits tight on the vial.]

4. Firmly screw the solid cap on the Sampler Vial and clean the vial completely with the gauze cloth. With a **ballpoint pen** record the sample number, corresponding to the sample location, on the cap's label. [**Note**: Do not use a Sharpie marker.]

5. On the Field Deployment Report, record: (a) date and time of retrieval (to nearest minute); and (b) any other information deemed relevant.

6. Return the sampling cap to the Sampling Cap container. Fill the sampling hole with soil, sand, or other suitable material.

7. After all samples have been retrieved, verify that the bags containing Collectors have been properly sealed and place them and the provided equipment in the Field Kit. Stow the remaining components in the lower compartment of the Field Kit.

Note: Each Collector contains two adsorbent cartridges. BEACON will analyze one cartridge per Collector; however, the second cartridge in each Collector can be analyzed as a field sample duplicate. Olin will note at which locations, if any, duplicates are to be analyzed by writing separate entries corresponding to the sample location followed by the letter "D" (*i.e*, 3, 3-D, 4, 4-D) on the Chain-of-Custody Form. It is not necessary to alter the deployment pattern to have the duplicate samples analyzed. There is an additional per sample charge for analysis of any duplicates.

Note: It is not necessary to return the gauze pads or wire with the Field Kit, but return *all* the other materials and equipment (tools, containers, sampling caps, *etc.*).

IV. Forms

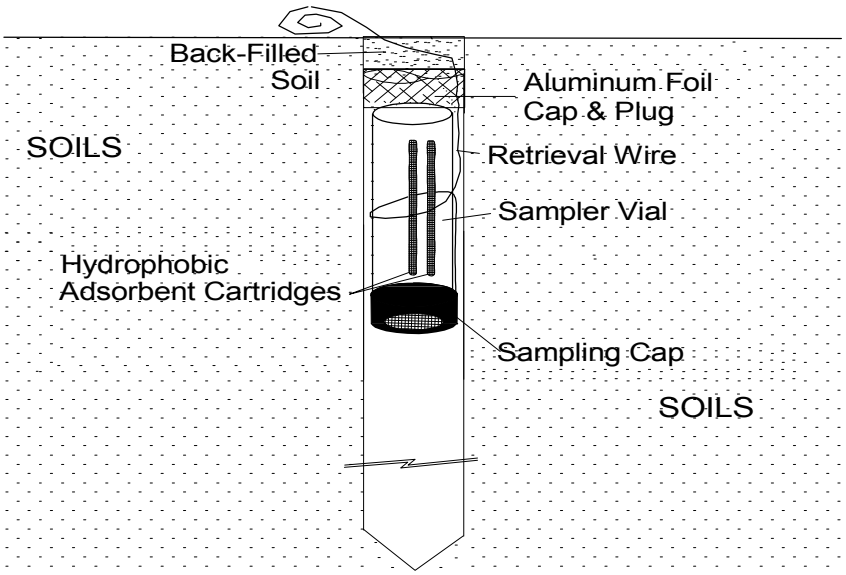
The Field Kit also contains a **Chain-of-Custody Form** and a **Field Deployment Report**.

A. The Chain-of-Custody Form is to be completed in accordance with Section I.

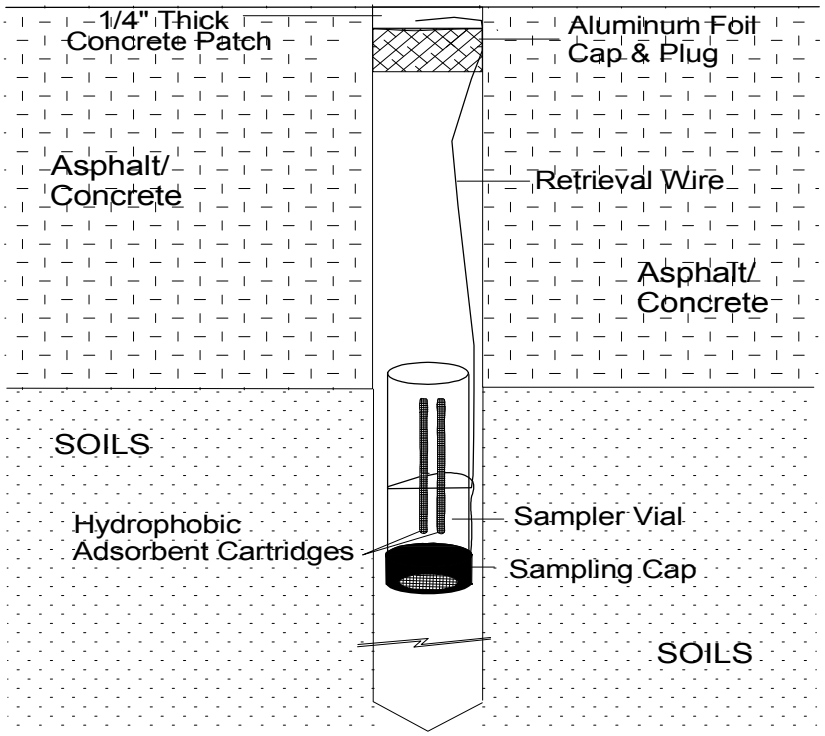
B. The Field Deployment Report is to be filled out as indicated in Section III.

EMFLUX® COLLECTOR

DEPLOYMENT THROUGH SOILS



DEPLOYMENT THROUGH ASPHALT or CONCRETE



Appendix D

Beacon Report No. EM 1617

BEACON Report No. EM1617

EMFLUX® Passive Soil-Gas Survey

SHOPS AREA INVESTIGATION
BADGER ARMY AMMUNITION PLANT, WI

Prepared for

Olin Corporation
One Badger Road
Baraboo, WI 53913

by

Beacon Environmental Services, Inc.
323 Williams Street
Suite D
Bel Air, MD 21014

December 15, 2003

Applying Results from Soil-Gas Surveys

The utility of soil-gas surveys is directly proportional to their accuracy in reflecting and representing changes in the subsurface concentrations of source compounds. Passive soil-gas survey results are the mass collected from the vapor-phase emanating from the source. The vapor-phase is merely a fractional trace of the source, so, as a matter of convenience, the units used in reporting detection values from EMFLUX® surveys are smaller than those employed for source-compound concentrations.

The critical fact is that, whatever the relative concentrations of source and associated soil gas, best results are realized when the ratio of soil-gas measurements to actual subsurface concentrations remains as close to constant as the real world permits. It is the reliability and consistency of this ratio, not the particular units of mass (*e.g.*, nanograms) that determine usefulness. Thus, BEACON emphasizes the necessity of conducting — at minimum — follow-on intrusive sampling at one or two points which show relatively high EMFLUX® values to obtain corresponding concentrations of soil and groundwater contaminants. These correspondent values furnish the basis for approximating the required ratio. Once that ratio is established, it can be used in conjunction with EMFLUX® measurements (regardless of the units adopted) to estimate subsurface contaminant concentrations across the survey field. It is important to keep in mind, however, that specific conditions at individual sample points, including soil porosity and permeability, depth to contamination, and perched ground water, can have significant impact on soil-gas measurements at those locations.

When EMFLUX® Surveys are handled in this way, the data provide information that can yield substantial savings in drilling costs and in time. They furnish, among other things, a checklist of compounds expected at each survey location and help to determine how and where drilling budgets can most effectively be spent.

EMFLUX® Survey Number: EM1617

Shops Area Investigation
Badger Army Ammunition Plant, WI

This EMFLUX® Soil-Gas Survey Report has been prepared for Olin Corporation (OLIN) by Beacon Environmental Services, Inc. (BEACON) in accordance with the terms of Purchase Order No. 93250, dated November 10, 2003. BEACON's principal technical contact at OLIN for this project has been Mr. Joel Janssen.

In this survey, EMFLUX® Collectors were deployed in three separate areas as part of the overall Shops Area Investigation. Samples SG-58 through SG-68 were deployed in the Locomotive and Fire Training Area, samples SG-69 through SG-73 were deployed in the Salvage Yard, and samples SG-74 through SG-85 were deployed in the Historic Shops area.

1. Objectives

Soil-gas samples were collected as part of the Shops Area Investigation to screen the sites for the presence of targeted compounds in the gas phase. Results will be used to profile contamination in soil and/or ground water at the site, thereby determining the distribution and relative strength of detected contaminants.

2. Target Compounds

This survey targeted the 12 compounds listed in **Attachment 1**, which supplies the resulting laboratory data in nanograms (ng) of specific compound per cartridge. **Table 1** provides the data for those compounds detected at one or more locations.

3. Survey Description

- No. of Field Sample Points (Locomotive and Fire Training Area): 11
- No. of Field Sample Points (Salvage Yard): 5
- No. of Field Sample Points (Historic Shops): 12
- No. of Duplicate Field Samples: 1
- No. of Trip Blanks: 1
- Total No. of EMFLUX® Samples: 30

Field sample locations for all three areas are shown on **Figure 1**. **Figure 2-1** shows the field sample locations for the Locomotive and Fire Training Area, **Figure 3-1** shows the field sample locations for the Salvage Yard, and **Figure 4-1** shows the field sample locations for the Historic Shops area.

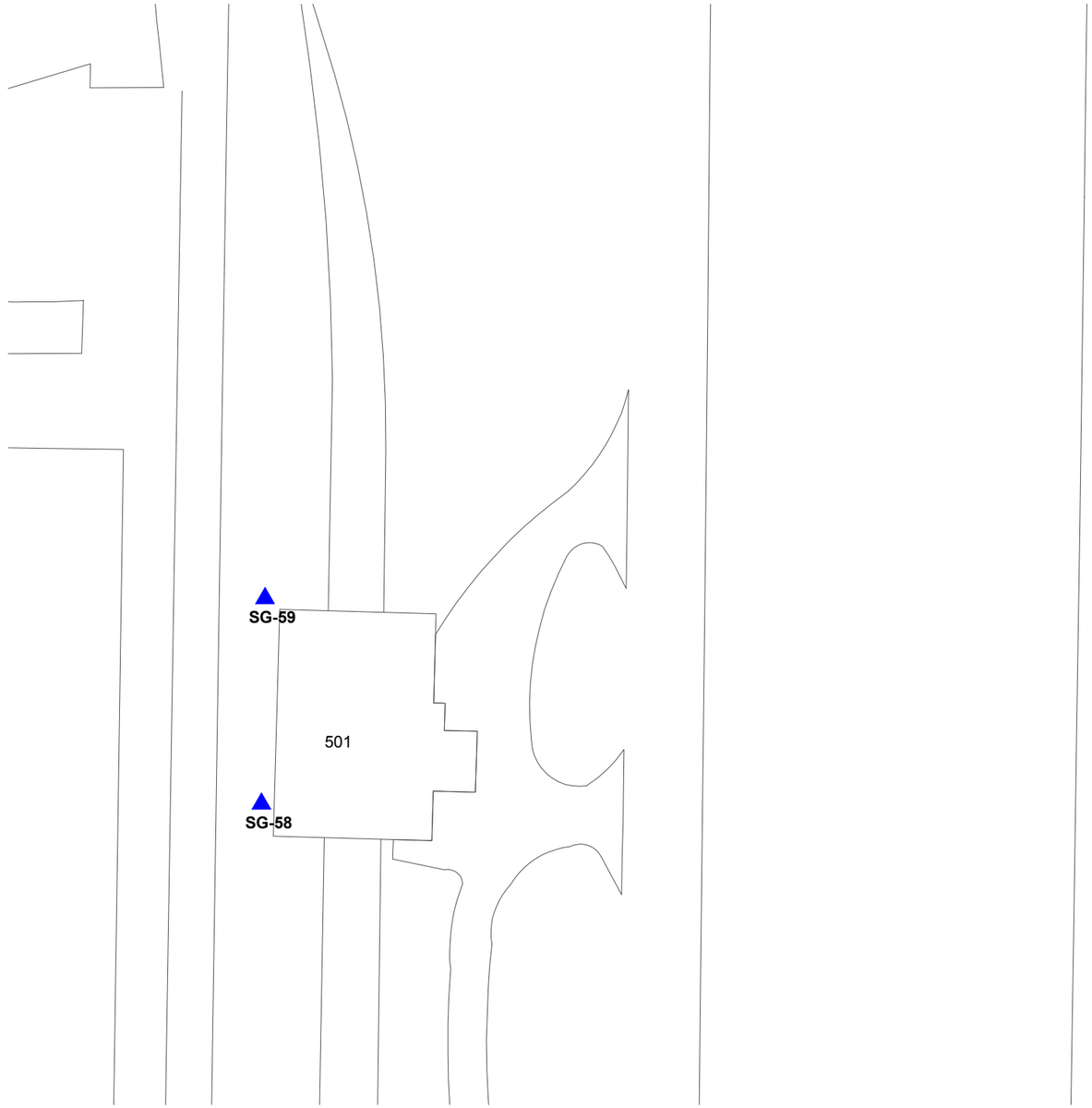
BEACON ENVIRONMENTAL SERVICES, INC.

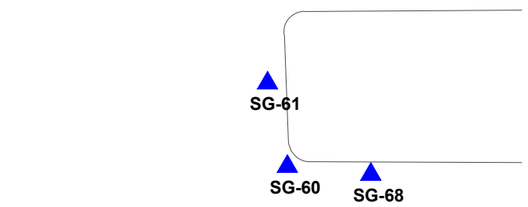
323 Williams Street, Suite D, Bel Air, MD, 800-878-5510
Beacon Project No. EM1617, December 2003

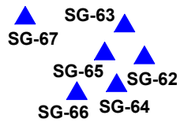
Scale in Feet
0 500 1,000

Figure 1
EMFLUX Soil-Gas Sample Locations

Shops Area Investigation
Badger Army Ammunition Plant, WI







BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD, 800-878-5510
Beacon Project No. EM1617, December 2003

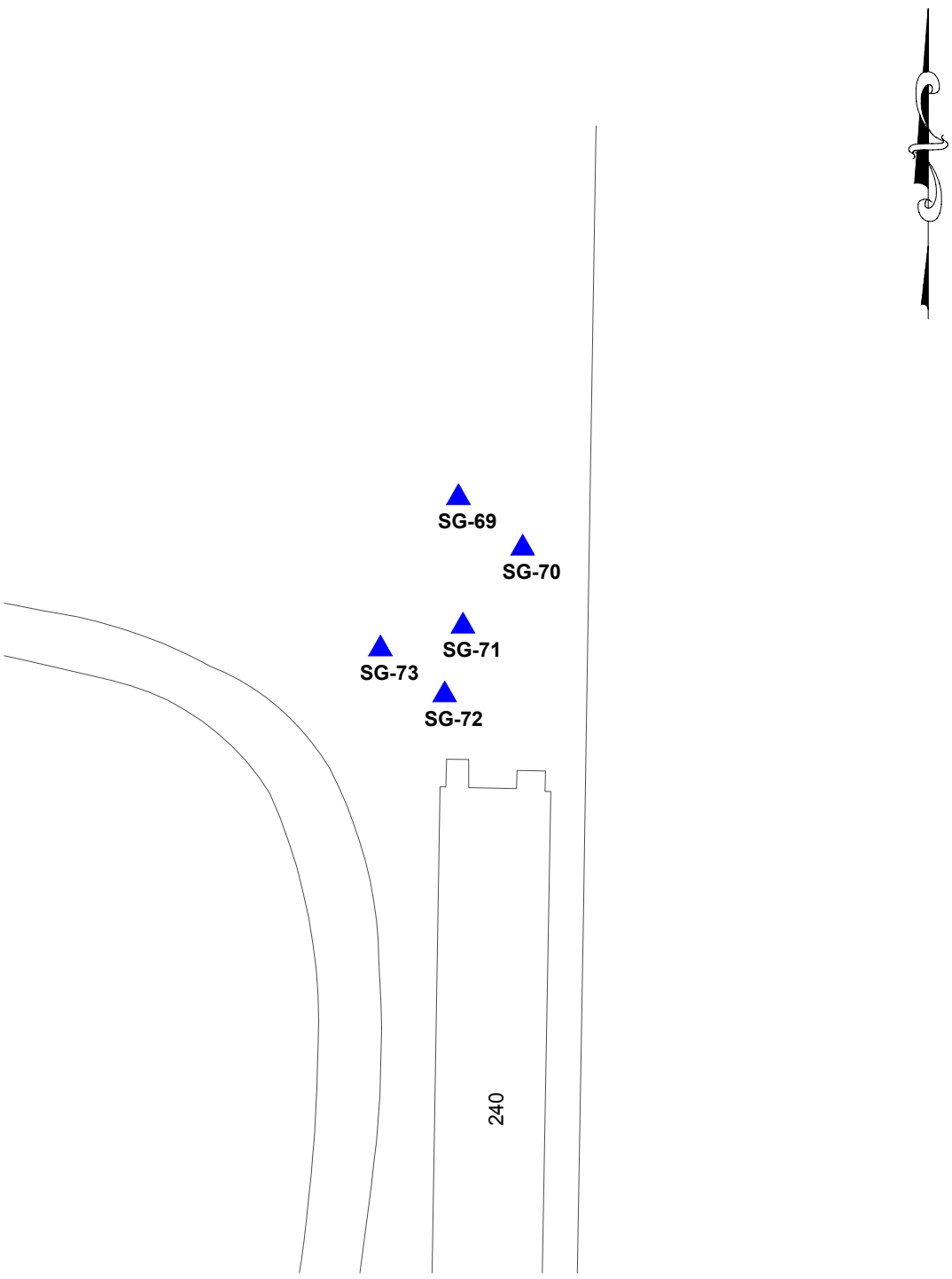
SG-64 EMFLUX SOIL-GAS SAMPLE LOCATION

Scale in Feet

0 40 80

Figure 2-1
EMFLUX Soil-Gas Sample Locations

Locomotive and Fire Training Area
Shops Area Investigation
Badger Army Ammunition Plant, WI



SG-71 EMFLUX SOIL-GAS SAMPLE LOCATION

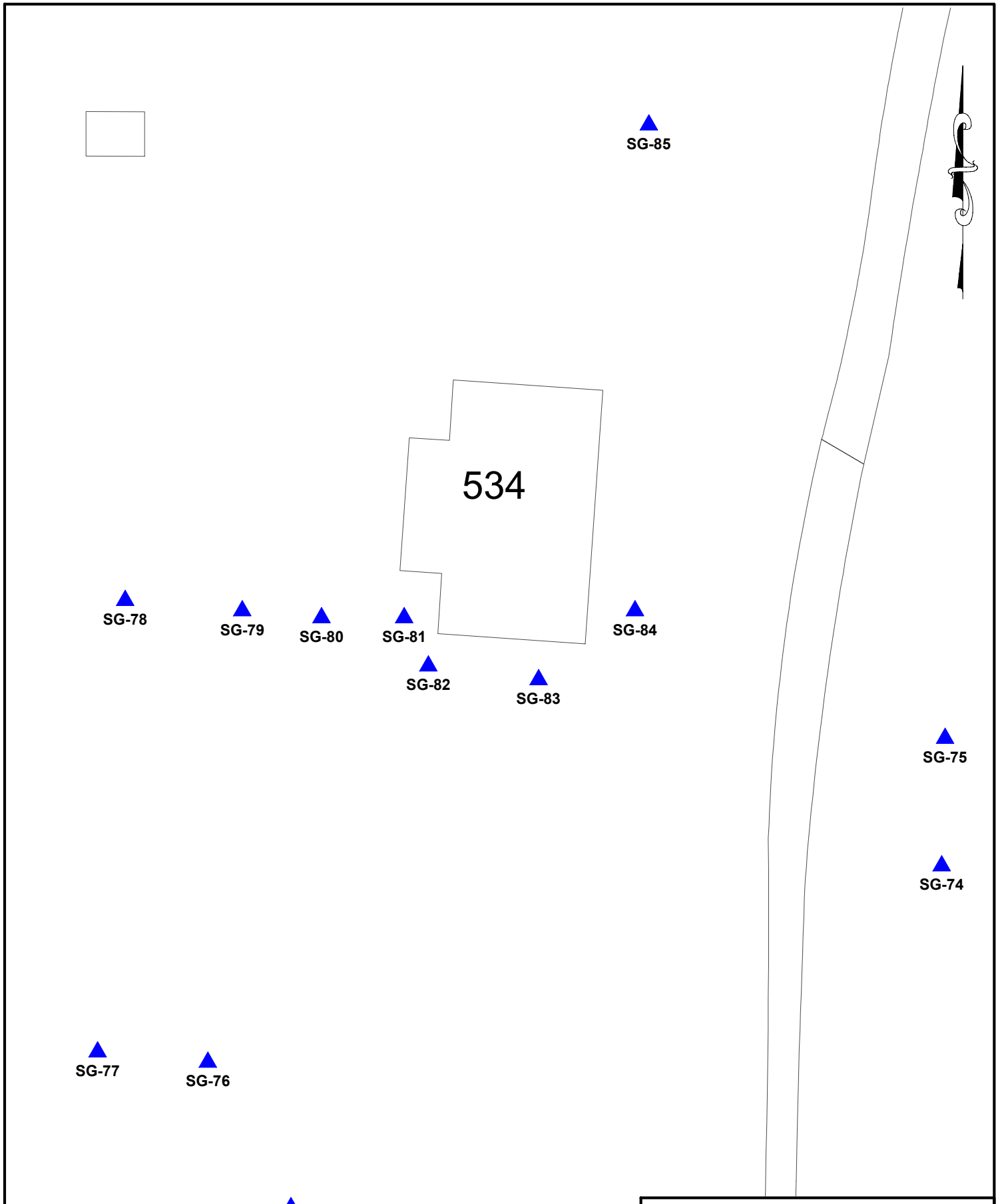
Scale in Feet

0 40 80

Figure 3-1
EMFLUX Soil-Gas Sample Locations

Salvage Yard
Shops Area Investigation
Badger Army Ammunition Plant, WI

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014, 800-878-5510
Beacon Project No. EM1617, December 2003



SG-74 EMFLUX SOIL-GAS SAMPLE LOCATION

Scale in Feet

0 40 80

BEACON ENVIRONMENTAL SERVICES, INC.

323 Williams Street, Suite D, Bel Air, MD 21014, 800-878-5510
Beacon Project No. EM1617, December 2003

Figure 4-1
EMFLUX Soil-Gas Sample Locations

Historic Shops
Shops Area Investigation
Badger Army Ammunition Plant, WI

4. Field Work

OLIN was provided an EMFLUX® Field Kit with the equipment needed to conduct a 28-point EMFLUX® Soil-Gas Survey. Collectors were deployed on November 6, 2003, and were retrieved on December 1, 2003, in accordance with the EMFLUX® Timing Model. **Attachment 2** describes the field procedures used. Individual deployment and retrieval times will be found in the Field Deployment Report (**Attachment 3**).

5. Analysis and Reporting Dates

- BEACON's laboratory received 30 samples for analysis on December 2, 2003.
- BEACON's laboratory analyzed the samples for the specified compounds, using thermal desorption and a capillary-column gas chromatograph (GC) with a photoionization detector (PID) in series with a dry electrolytic conductivity detector (DELCD) in accordance with EPA Method 8021 **(Attachment 4)**.
- Analysis was completed on December 4, 2003. Following a laboratory review, results were provided to OLIN on December 8, 2003.

6. Report Notes and Quality Assurance/Quality Control Factors

- **Table 1** provides survey results in nanograms per cartridge by sample-point number and compound name. The quantitation levels represent values above which quantitative laboratory results can be achieved within specified limits of precision and with a high degree of confidence. The quantitation level for each compound, therefore, provides a reliable basis for comparing the relative strength of any detection of that compound.

- **Data Compatibility**. It is important to note that when sample locations are covered with or near the edge of an artificial surface (*e.g.*, asphalt or concrete), sample measurements are often distorted (increased) significantly. Such distortion can be attributed to the fact that gas rising from sources beneath impermeable caps tends to reach equilibrium underneath the cap. Thus, a reading taken below or near an impermeable surface is much higher than it would be in the absence of such a cap.

- The **Chain-of-Custody** form, which was shipped with the samples for this survey, is supplied as **Attachment 5**.

- **Laboratory QA/QC procedures** consist of control blanks and verifications, as well as system calibration, as specified for EPA Method 8021. Laboratory personnel conducted internal control blanks and internal control verification analyses daily to ensure that the system was contaminant free and properly calibrated. The system was calibrated using

external-standard procedures to at least three different concentrations for each compound targeted. Internal control verification and continuing control verification were performed daily.

- **QA/QC Contaminant Corrections.** Following EPA guidelines, EMFLUX® laboratory data is not corrected for method blank or trip blank sample contamination values; any contamination detected on QA/QC samples is reported in **Attachment 1**.

- **Laboratory method blanks** are run each day with project samples to identify contamination present in the laboratory. If contamination is detected on a method blank, measurements of identical compounds on samples analyzed the same day are considered to be suspect and are flagged in the laboratory report. The laboratory method blanks analyzed in connection with the present samples revealed no contamination.

- The **trip blank** is an EMFLUX® cartridge prepared, transported, and analyzed with other samples but intentionally not exposed. Any target compounds identified on the trip blanks are reported in the laboratory data. The analysis of the trip blank (labeled Trip-1 in **Attachment 1**) reported none of the targeted compounds, indicating that the survey site itself is the source of detected contamination.

- **Duplicates.** EMFLUX® sample collectors are prepared with two cartridges for subsequent duplicate or confirmatory sample analysis. At OLIN's request, duplicate analysis was performed for sample SG-69, designated with a SG-69D. None of the targeted compounds were identified on the field sample or the duplicate field sample.

- **Survey results.** Carbon Tetrachloride and 1,1,1-Trichloroethane were identified in this survey at the Historic Shops area. **Figure 4-2** provides the locations reporting these compounds and the measurements recorded. No targeted compounds were identified at the other two areas investigated in this project.

- Survey findings are relative exclusively to this project and should not routinely be compared with results of other EMFLUX® Surveys. *To establish a relationship between reported soil-gas measurements and actual subsurface contaminant concentrations, which will indicate those detections representing significant subsurface contamination, BEACON recommends the guidelines on the inside front cover of this report.*

- The following **Attachments** are included:

  -1- Laboratory Report
  -2- EMFLUX® Field Procedures
  -3- Field Deployment Report
  -4- Laboratory Procedures
  -5- Chain-of-Custody Form

Table 1

Shops Area Investigation
Badger Army Ammunition Plant, WI

Results in Nanograms (ng)
Analytical Method: EPA Method 8021
Analysis Completed: December 4, 2003

SAMPLE NO.	SG-58	SG-59	SG-60	SG-61	SG-62	SG-63
COMPOUNDS						
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25

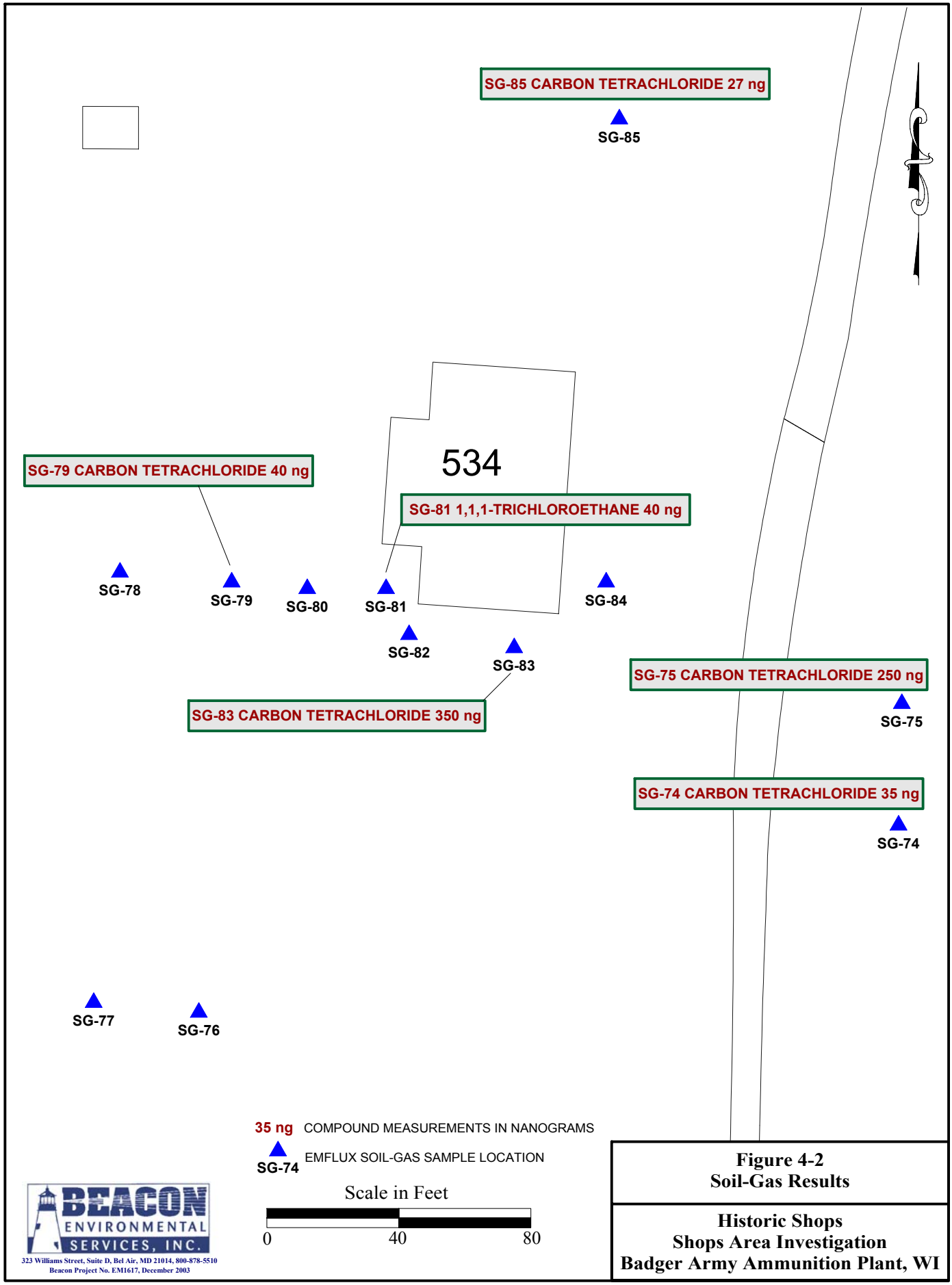
SAMPLE NO.	SG-64	SG-65	SG-66	SG-67	SG-68	SG-69
COMPOUNDS						
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25

SAMPLE NO.	SG-69D	SG-70	SG-71	SG-72	SG-73	SG-74
COMPOUNDS						
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	**35**

SAMPLE NO.	SG-75	SG-76	SG-77	SG-78	SG-79	SG-80
COMPOUNDS						
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	**250**	<25	<25	<25	**40**	<25

SAMPLE NO.	SG-81	SG-82	SG-83	SG-84	SG-85
COMPOUNDS					
1,1,1-Trichloroethane	**40**	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	**350**	<25	**27**

Reported Quantitation Level = 25 nanograms



BEACON ENVIRONMENTAL SERVICES, INC.

323 Williams Street, Suite D, Bel Air, MD 21014, 800-878-5510
Beacon Project No. EM1617, December 2003

Figure 4-2
Soil-Gas Results

Historic Shops
Shops Area Investigation
Badger Army Ammunition Plant, WI

Attachment 1

Laboratory Report

Attachment 1

Shops Area Investigation
Badger Army Ammunition Plant, WI

Results in Nanograms (ng)
Analytical Method: EPA Method 8021
Analysis Completed: December 4, 2003

SAMPLE NO.	SG-58	SG-59	SG-60	SG-61	SG-62	SG-63
COMPOUNDS						
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25
Methylene Chloride	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25

SAMPLE NO.	SG-64	SG-65	SG-66	SG-67	SG-68	SG-69
COMPOUNDS						
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25
Methylene Chloride	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25

Reported Quantitation Level = 25 nanograms

Attachment 1
(continued)
Shops Area Investigation
Badger Army Ammunition Plant, WI

Results in Nanograms (ng)
Analytical Method: EPA Method 8021
Analysis Completed: December 4, 2003

SAMPLE NO.	SG-69D	SG-70	SG-71	SG-72	SG-73	SG-74
COMPOUNDS						
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25
Methylene Chloride	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	**35**
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25

SAMPLE NO.	SG-75	SG-76	SG-77	SG-78	SG-79	SG-80
COMPOUNDS						
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25
Methylene Chloride	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	**250**	<25	<25	<25	**40**	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25

Reported Quantitation Level = 25 nanograms

Attachment 1
(continued)
Shops Area Investigation
Badger Army Ammunition Plant, WI

Results in Nanograms (ng)
Analytical Method: EPA Method 8021
Analysis Completed: December 4, 2003

SAMPLE NO.	SG-81	SG-82	SG-83	SG-84	SG-85	Trip-1
COMPOUNDS						
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25
Methylene Chloride	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	**40**	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	**350**	<25	**27**	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25

Reported Quantitation Level = 25 nanograms

Attachment 2

FIELD PROCEDURES FOR EMFLUX® SOIL-GAS SURVEYS

The following field procedures are routinely used during EMFLUX® Soil-Gas Surveys. Modifications can be and are incorporated from time to time in response to individual project requirements. In all instances, BEACON adheres to EPA-approved Quality Assurance and Quality Control practices.

A. Field personnel carry EMFLUX® system components and support equipment to the site and deploy the EMFLUX® Collectors in a prearranged survey pattern. An EMFLUX® Collector consists of a glass vial containing hydrophobic adsorbent cartridges with a length of wire attached to the vial for retrieval. Although EMFLUX® Collectors require only one person for emplacement and retrieval, the specific number of field personnel required depends upon the scope and schedule of the project. Each Collector emplacement generally takes less than two minutes.

B. At each survey point a field technician clears vegetation as needed and, using a slide hammer with a ½″ diameter probe or a hammer drill with a ½″ diameter bit, creates a hole three-feet deep. The technician then uses a hammer and a ¾″ diameter pointed metal stake to widen the top four inches of the hole. [Note: For locations covered with asphalt, concrete, or gravel surfacing, the field technician first drills a 1″- to 1½″-diameter hole through the surfacing to the soils beneath. If necessary, the Collector can be sleeved with a ¾″ i.d. metal sleeve.]

C. The technician then removes the solid plastic cap from an EMFLUX® Collector and replaces it with a Sampling Cap (a plastic cap with a hole covered by screen meshing). The technician inserts the Collector, with the Sampling Cap end facing down, into the hole (**see attached figure**). The Collector is then covered with either local soils for uncapped locations or, for capped locations, aluminum foil and a concrete patch. The Collector's location, time and date of emplacement, and other relevant information are recorded on the Field Deployment Form.

D. One or more trip blanks are included as part of the quality-control procedures.

E. Once all EMFLUX® Collectors have been deployed, field personnel schedule Collector recovery and depart, taking all other equipment and materials with them.

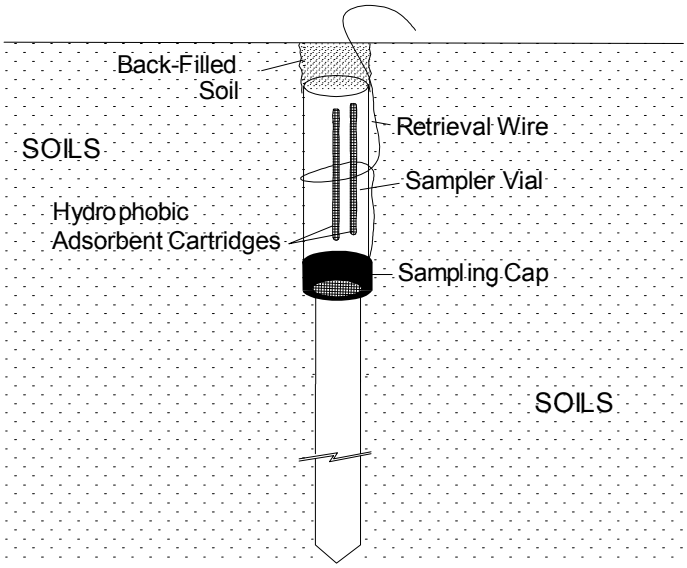
F. Field personnel retrieve the Collectors at the end of the exposure period. At each location, a field technician withdraws the Collector from its hole, removes the retrieval wire, and wipes the outside of the vial clean using gauze cloth; following removal of the Sampling Cap, the threads of the vial are also cleaned. A solid plastic cap is screwed onto the vial and the sample location number is written on the label. The technician then records sample-point location, date, time, etc. on the Field Deployment Form.

G. Sampling holes are refilled with soil, sand, or other suitable material. If Collectors have been installed through asphalt or concrete, the hole is filled to grade with a plug of cold patch or cement.

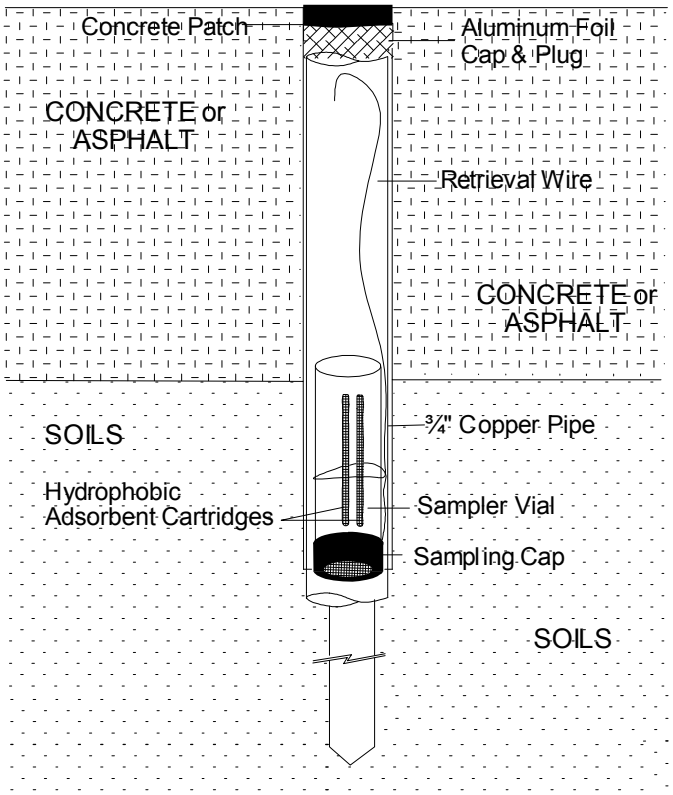
H. Following retrieval, field personnel ship or carry the EMFLUX® Collectors to the specified analytical laboratory.

EMFLUX® COLLECTOR

DEPLOYMENT IN SOILS



DEPLOYMENT THROUGH CONCRETE OR ASPHALT



Attachment 3

Field Deployment Report

EMFLUX PASSIVE SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

Project Information	
Beacon Project No.:	EM1617 Shops
Site Name:	~~Laboratory Solvent Investigation~~
Site Location:	Badger AAP, WI

BEACON ENVIRONMENTAL SERVICES, INC.

323 Williams Street, Suite D, Bel Air, MD 21014, 800-878-5510

Client Information	
Company Name:	Olin Corporation
Office Location:	Baraboo, WI
Samples Collected By:	Joel Janssen

FIELD SAMPLE ID	Date Emplaced / Time Emplaced	Date Retrieved / Time Retrieved	FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, sampling hole depth, cartridge/vial condition)
	11/6/03	12/1/03	
SG-58	1420	1035	SW corner of Loco shop
-59	1425	1037	NW " " "
-60	1435	1045	Grass, Fire Training Area
-61	1438	1047	" "
-62	1440	1049	" "
-63	1442	1051	" "
-64	1445	1053	" "
-65	1448	1055	" "
-66	1450	1057	" "
-67	1452	1059	" "
-68	1455	1102	" "
-69	1510	1110	Grass, Salvage Yard - Drum Cleaning Area (DUP)
-70	1513	1113	" "
-71	1516	1116	" "
-72	1519	1119	" "

EMFLUX PASSIVE SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

Project Information	
Beacon Project No.:	EM1617 Shops
Site Name:	~~Laboratory Solvent Investigation~~
Site Location:	Badger AAP, WI

BEACON ENVIRONMENTAL SERVICES, INC.

Client Information	
Company Name:	Olin Corporation
Office Location:	Baraboo, WI
Samples Collected By:	Joel Janssen

FIELD SAMPLE ID	Date Emplaced / Time Emplaced	Date Retrieved / Time Retrieved	FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, sampling hole depth, cartridge/vial condition)
	11/6/03	12/1/03	
SG-73	1525	1122	Grass, Salvage Yard - Drum Cleaning Area
74	1530	1132	Grass, Historic Shops, Oil Storage
75	1533	1134	" " "
76	1536	1137	" " Motor Repair
77	1540	1140	" " "
78	1543	1142	" " "
79	1546	1145	" " "
80	1550	1148	" " Septic (Bus Repair)
81	1553	1150	" " " (Bus Repair)
82	1556	1153	" " SW Door Way Bus Repair
83	1600	1156	" " SE Door Way Bus Repair
84	1605	1158	" " E side Bus Repair
85	1610	1200	" " Wash Rack (Vial broke during retrieval - Replaced)

Attachment 4

LABORATORY PROCEDURES FOR EMFLUX® ADSORBENT CARTRIDGES

Following are laboratory procedures used with the EMFLUX® Soil-Gas System, a screening technology for expedited site investigation. After exposure, EMFLUX® cartridges are analyzed using U.S. EPA Method 8021 as described in the Solid Waste Manual (SW-846) for screening purposes. This method, which is modified to accommodate thermal desorption screening of the adsorbent cartridges, uses a gas chromatograph equipped with a capillary column and a photo ionization detector (PID) in series with a dry electrolytic conductivity detector (DELCD). This procedure is summarized below:

A. EMFLUX® cartridges are placed in the thermal desorbtion chamber, where they are purged with carrier gas then desorbed into the capillary column. The capillary column separates the sample into single component analytes. Analytes in the carrier gas are detected with a PID then a DELCD.

B. The laboratory uses a 105-m, 0.53-mm-i.d., 3 µm-film-thickness MXT-624 capillary column for separation during analysis.

C. The PID is set on high gain and the DELCD is set on low gain; ultra zero grade dry air is used in the DELCD.

D. Lab personnel conduct internal control blank and internal control verification analyses daily to ensure that the system is contaminant free and properly calibrated. The system is calibrated using the external standard calibration procedure to at least three different concentration levels for each compound targeted, with the lowest concentration level at or near the method detection limit. Internal control verification and continuing control verification were performed daily.

E. The instrumentation used for these analyses is an SRI 8610 Gas Chromatograph, connected to a PID in series with a DELCD and equipped with a thermal desorber.

Attachment 5

Chain-of-Custody Form

CHAIN-OF-CUSTODY
EMFLUX PASSIVE SOIL-GAS SAMPLES

Project Information	
Beacon Project No.:	EM1617 Shops
Site Name:	~~Laboratory Solvent Investigation~~
Site Location:	Badger AAP, WI
Analytical Method:	EMFLUX EPA Method 8021
Target Compounds:	EMFLUX EM1617 Chlorinated Compound List

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014, 800-878-5510

Client Information	
Company Name:	Olin Corporation
Office Location:	Baraboo, WI
Samples Submitted By:	Joel Janssen
Contact Phone No.:	608 - 643-3361

Field Sample ID	Lab Sample ID (for lab use only)	Comments (only necessary if problem or discrepancy)			
		Condition of sample or vial	Date	Time	Initial
Trip-1			12/1/03		JJ
SG-58				1035	JJ
SG-59				1037	JJ
SG-60				1045	JJ
SG-61				1047	JJ
SG-62				1049	JJ
SG-63				1051	JJ
SG-64				1053	JJ
SG-65				1055	JJ
SG-66				1057	JJ
SG-67				1059	JJ
SG-68				1102	JJ
SG-69				1110	JJ
SG-69D				1110	JJ
SG-70				1113	JJ
SG-71				1116	JJ
SG-72				1119	JJ
SG-73				1122	JJ
SG-74				1132	JJ
SG-75				1134	JJ

Shipment of Field Kit to Site — Custody Seal # 00284066 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Ryan Scheich	11/04/03 - 1700	FedEx	Joel Janssen	11/5/03 - 1300

Shipment of Field Kit to Laboratory — Custody Seal # 00284071 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Joel Janssen	12/1/03 - 1330	Fedex	Ryan Scheich	12-02-03 / 0930

CHAIN-OF-CUSTODY
EMFLUX PASSIVE SOIL-GAS SAMPLES

Project Information	
Beacon Project No.:	EM1617 Shops
Site Name:	~~Laboratory Solvent Investigation~~
Site Location:	Badger AAP, WI
Analytical Method:	EMFLUX EPA Method 8021
Target Compounds:	EMFLUX EM1617 Chlorinated Compound List

BEACON ENVIRONMENTAL SERVICES, INC.
323 Williams Street, Suite D, Bel Air, MD 21014, 800-878-5510

Client Information	
Company Name:	Olin Corporation
Office Location:	Baraboo, WI
Samples Submitted By:	Joel Janssen
Contact Phone No.:	608-643-3361

Field Sample ID	Lab Sample ID (for lab use only)	Comments (only necessary if problem or discrepancy) Condition of sample or vial	Date	Time	Initial
SG-76			12/1/03	1137	JJ
SG-77				1140	JJ
SG-78				1142	JJ
SG-79				1145	JJ
SG-80				1148	JJ
SG-81				1150	JJ
SG-82				1153	JJ
SG-83				1156	JJ
SG-84				1158	JJ
SG-85		Vial was broke, prior to retrieval; replaced w/ new vial.		1200	JJ

Shipment of Field Kit to Site — Custody Seal # 00284066 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Ryan Schmidt	11/04/03 - 1700	FEDEX	Joel Janssen	11/5/03 - 1300

Shipment of Field Kit to Laboratory — Custody Seal # 00284071 Intact? (Y) N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
Joel Janssen	12/1/03 - 1330	Fedex	Ryan Schmidt	12-02-03 / 0930