TECHNICAL OPERATIONS PLAN PHASE 2 STAGE 2 CONFIRMATION STUDY KANSAS CITY MO

9/19/1986

ECOLOGY AND ENVIRONMENT

TECHNICAL OPERATIONS PLAN
PHASE II, STAGE 2 CONFIRMATION STUDY
INSTALLATION RESTORATION PROGRAM
RICHARDS-GEBAUR AFB, MISSOURI

September 19, 1986

Prepared for:

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1. INTRODUCTION

Ecology and Environment, Inc., (E & E) has prepared this Technical Operations Plan for studies at Richards-Gebaur Air Force Base (AFB), Belton, Missouri. The plan presents the site-specific work plans to be used to satisfy the requirements set forth in the delivery order to the Survey--Phase II Installation Restoration Program (IRP).

This document is the result of an evaluation of the Phase I--Records Search Report, an evaluation of the Phase II--Confirmation Report for the two landfills on the base, participation in a presurvey meeting and tour of the sites on the base, and additional information agreed to during the presurvey meeting with Dr. John K. Yu (OEHL/TSS) and participating personnel. The work plans for each site are designed to address the scope of activities described for either Stage 1 or Stage 2 of the Phase II program depending upon whether or not the site has been previously investigated. The current delivery order identifies this investigation as a Stage 2 investigation, which consists of the quantification of data on sites deemed as needing additional work in the Stage 1 report.

The field investigation procedures to be followed are consistent with rules and regulations set forth by the United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), Nuclear Regulatory Commission (NRC), and the Department of Transportation (DOT). Investigations will also be conducted in accordance with provisions of the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

The installation history and practices involving hazardous wastes are described in the Phase I report and will not be reiterated here. The listings of sites recommended in the Phase I and II reports for investigation includes the following:

- South Landfill;
- Northeast Landfill, as defined by new information from the Phase II, Stage 1 report;
- North Burn Area (Fire Training Area);
- Herbicide Burial Area;
- Oil-Saturated Area;
- Hazardous Waste Drum Storage Area--Bldg. 923; and
- POL Storage Area.

2. PROPOSED WORK PLANS FOR STAGE 2 SITE INVESTIGATIONS

The work plans were developed to accomplish those tasks designated under directive F33615-83-D-4003, Proposed Order 13, Phase II, Stage 2 investigation of Richards-Gebaur AFB, Belton, Missouri. These tasks are described in Section 1 of the directive and consist of:

- Determining the presence or absence of contaminated substances within the specified areas of investigation;
- If contamination exists, determining its magnitude and extent and the potential for migration of these contaminants in the various environmental media;
- Assessing the potential environmental and health risks associated with contaminants in the local environment. This assessment will be based on applicable local, state, and/or federal standards only.
- Delineating additional investigations required beyond the present investigation stage to accomplish Phase II objectives.

To accomplish these goals, several field investigation techniques will be used, including:

- Geophysical surveys to determine the perimeter of the various landfill sites and to characterize buried metal, drums, and unique subsurface features, including contaminant plumes;

- Soil/sediment sampling, both grab and composite, to determine the presence or absence of shallow subsurface contamination;
- Monitoring well installation, with sampling of both the new and existing wells to determine potential environmental or health risks.

All samples will be split in the field, with delivery of 10% of the splits to OEHL/SA at Brooks AFB, Texas.

All soil and sediment samples will be monitored in the field for volatile contaminants. Water samples will be tested in the field for pH, conductivity, and temperature.

Laboratory analyses for water samples, as described in the analytical parameters subsections of this plan, have been assigned identification numbers in the Chemical Analyses Price Schedule of the contract. The parameters and corresponding numbers are listed in Table 2-1.

2.1 SOUTH LANDFILL (SITE 1)

Setting

The South Landfill (Site 1) is located in the south-central part of the base east of the flightline and on the west bank of Scope Creek (Figure 2-1, Number 1). There is a small man-made lake directly west and upgradient of the landfill. Site 5, the South Burn Area, is believed to be associated with this site but could not be identified during the presurvey site visit. The landfill officially was open from 1956 to 1960. Unauthorized dumping has been reported, and the majority of the material seen at the surface and toward the bank appears to have been disposed of after closure of the facility, based on the degree of weathering observed. During the presurvey site visit, the undergrowth was very thick and the water table was very high. No leachate seeps were observed at this time, although a seep was sampled during the Stage 1 investigation. Potential contaminants of concern are volatile organics, heavy metals, pesticides, phenols, and oil and grease.

Table 2-1

I.D. Number	Chemical Test Category
1	Trihalomethanes
2	Heavy Metals--Primary
3	Heavy Metals--Secondary
4	Oil and Grease
5	Total Organic Carbon (TOC)
6	Polychlorinated Biphenyls (PCBs)
7	Chlorinated Hydrocarbons (Pesticides)
8	Herbicides
9	Priority Pollutants (GC/MS Confirmation)
10	Purgeable Organics
11	Base/Neutral Extractables
12	Acid Extractables
13	Primary Drinking Water Standards
14	Secondary Drinking Water Standards

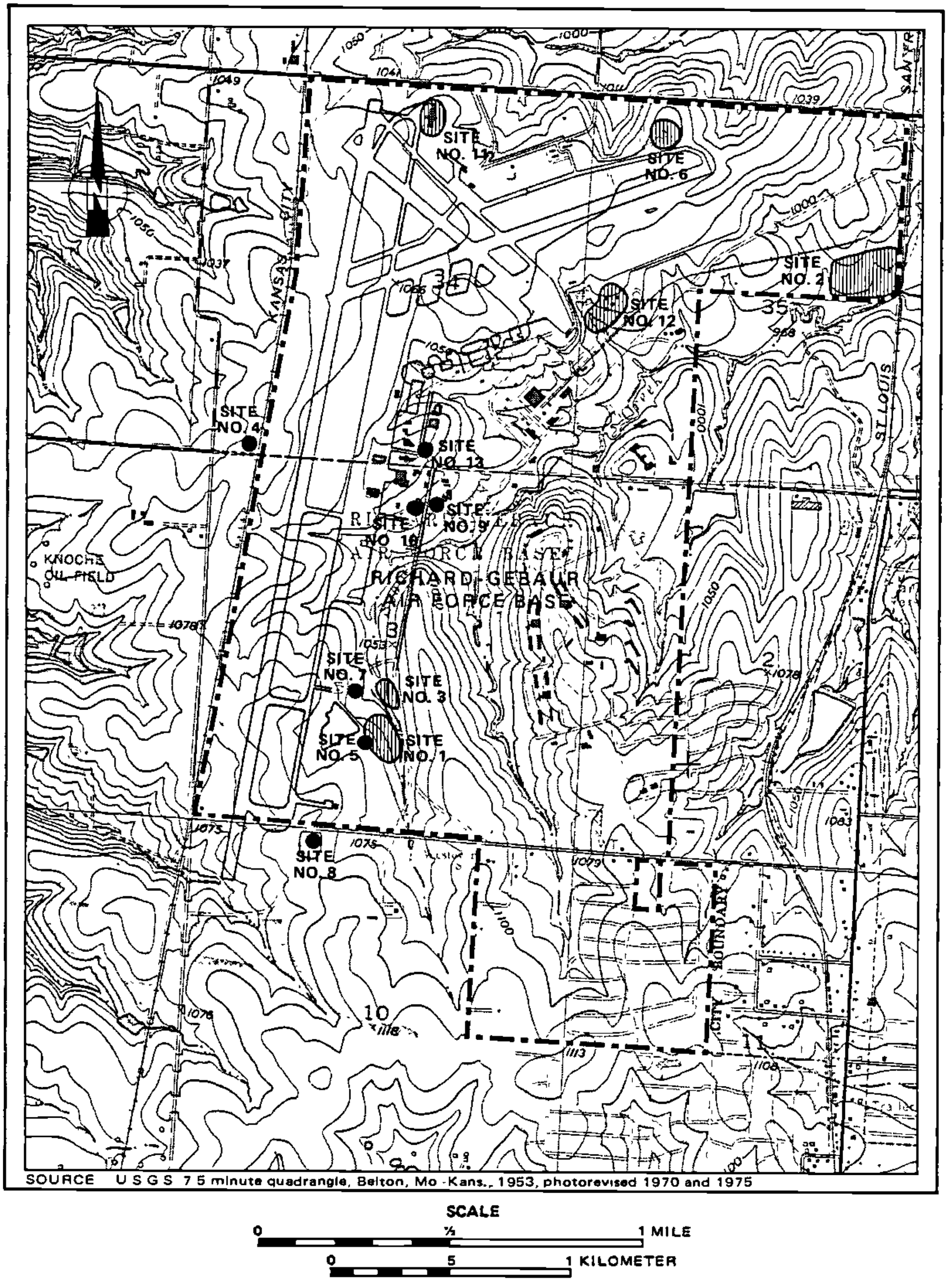

Figure 2—1 SITE LOCATION MAP, RICHARDS-GEBAUR AFB

Investigation

Borings. To determine the presence or absence or contamination and to augment the Stage 1 investigation, one soil boring is proposed in order to determine if contaminants have moved vertically in the soil column. This boring will be drilled to a depth of 15 feet and three split-spoon soil samples will be retrieved.

All drill cuttings will be drummed and staged until the analytical results are known. Richards-Gebaur AFB will provide a secure area for the drums and will be responsible for assigning the ultimate disposal points for the contaminated cuttings and groundwater.

Soil/Sediment Samples. A total of seven soil/sediment samples will be taken. Three will come from the shallow boring and three from discrete locations along the perimeter of the landfill along the creek. The last sample will be located further upstream along Scope Creek to serve as a background standard.

Water Samples. A total of five water samples also will be taken. One sample will be taken from the shallow boring, if groundwater is present; and three from Scope Creek or any leachate seeps that are detected. One sample will be taken from Scope Creek upgradient from the landfill.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and volatile organics (EPA 8010/8020). The water samples will be analyzed for volatile organics (EPA 601/602), total dissolved solids (TDS), priority pollutant metals, extractable priority pollutants (EPA 625), common anions, and phenols.

2.2 NORTHEAST LANDFILL (SITE 2)

Setting

The Northeast Landfill (Figure 2-1, Number 2) was vaguely identified in the Phase I report and investigated as such during Phase II Stage 1 work. The Stage 1 final report does indicate that additional information on the landfill was provided which identifies three trenches at the western end of the site (Figure 2-2). These three trenches are the main goal of the present study, which will treat this investigation as a Stage 1 confirmation study.

The landfill is located on the northeastern edge of the property boundary east of the firing range and adjacent to Scope Creek where the creek exits the base. It appears to have been opened after the South Landfill officially was closed in 1960, and remained in operation to approximately 1971. The suspected contaminants are organics, oil and grease, pesticides, and heavy metals. A portion of the original site boundary recently has been trenched for sewer lines and valuable information might be found in records from those operations.

Investigation

Background and Remote Sensing. To support the field investigation, resources have been allotted to locate and review any new information dealing with the Northeast Landfill and the nearby sewer lines. Available aerial photographs that cover the site for the years in question will be located and interpreted. This information will aid in locating the soil borings and grid lines for the geophysical study.

Geophysical Studies. To delineate the locations of the trenches, two geophysical surveys will be performed concurrently. First, a magnetometer survey will be conducted using a proton precession magnetometer to determine the presence of subsurface metal objects in the area where the trenches should be located. For the second survey, an electromagnetic terrain conductivity meter (Geonics EM-31 or EM-34) will be used to detect lateral changes in ground conductivity. Any lateral changes in conductivity should delineate the area disturbed by the trenches. It also may be possible to detect a contaminant plume associated with these trenches because of the reasonably high seasonal water table at this site.

Borings. A total of six shallow soil borings will be drilled to a depth of 20 feet. Three borings are allotted for the west trench and three borings for the double trench. One boring will be completed

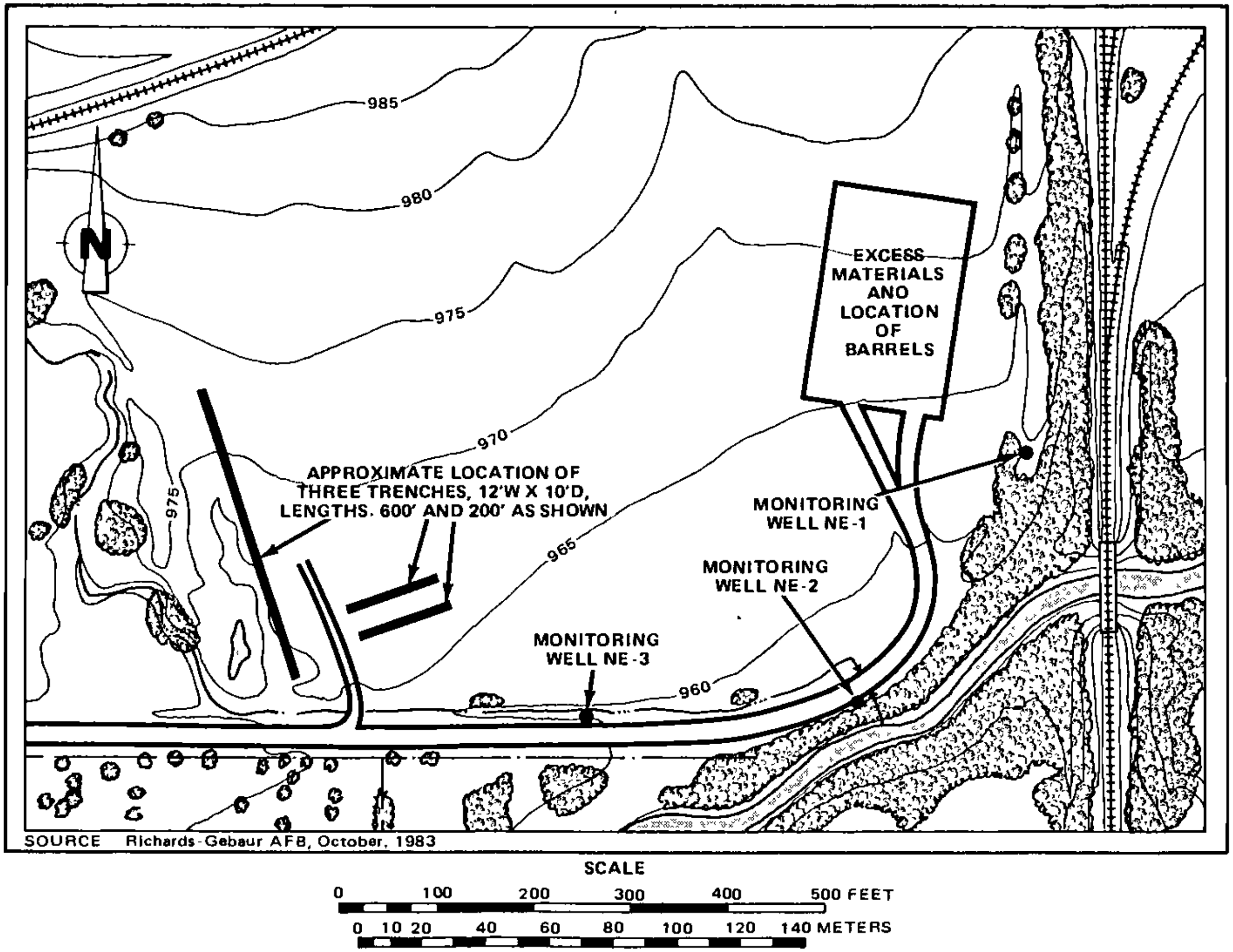

Figure 2–2 POSSIBLE LOCATIONS OF TRENCHES AT NORTHEAST LANDFILL

as a monitoring well. A maximum of three split-spoon soil samples will be taken at each boring.

Monitoring Wells. One monitoring well will be located downgradient of the trenched areas in the west part of the landfill in order to determine the effects of the trenches on groundwater quality. An additional well will be installed for background north of the landfill. Well installation methods are outlined in Section 8.

Soil/Sediment Samples. A total of 18 soil/sediment samples are proposed. These samples will come from the six shallow soil borings.

Water Samples. A total of 10 water samples also will be taken: five from the shallow boring holes, two from each of the new monitoring wells, and three from the existing monitoring wells. All three existing wells were located during the presurvey fieldwork; however, the wells were not opened to determine their current status.

Analytical Parameters. The soil/sediment samples will be analyzed for petroleum hydrocarbons, and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, priority pollutant metals, extractable priority pollutants, common anions, phenols, TDS, and volatile organics (EPA 601/602).

2.3 NORTH BURN AREA (SITE 6)

Setting

The North Burn Area (Figure 2-1, Number 6) is located to the north of the northeast flightline just below the northernmost boundary of the base. During the presurvey meeting, an apparent overflow of material into the drainage pathway was cited and added to the investigation of the site as originally proposed in the Phase I report. The facility has been in operation since the close of the South Burn Pit in 1965, and currently is in operation today. Recent improvements to the facility include a six-inch concrete rim around the concrete-lined pit.

Investigation

Soil Gas Survey. A soil gas survey will be performed using a maximum of 30 probes to characterize contamination at the site.

Borings. A total of three soil borings to a depth of 15 feet each will be drilled. They will be located along the perimeter so as best to identify any vertical contamination at the site.

Monitoring Wells. Three monitoring wells will be installed, two downgradient of the site and one upgradient. The wells will be sampled once, for a total of three groundwater samples.

Soil/Sediment Samples. Fifteen soil samples will be taken: nine from the three boreholes and six composite surface samples covering the area of overflow and along the surface drainage pathway. A composite sample will consist of no more than six aliquots within a radius of one meter around a central reference point. Aliquots will be taken from the top 12 inches of soil.

Water Samples. If water is encountered in the boreholes, three water samples will be taken. One surface water sample also is allocated at this time for any ponded water in the drainage pathways. Three groundwater samples will be taken.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, TDS, and volatile organics (EPA 601/602).

2.4 HERBICIDE BURIAL AREA (SITE 8)

Setting

The Herbicide Burial Site (Figure 2-1 Number 8) is located just east and adjacent to the main flightline in the southwest part of the base. The site was active only from mid-1970 to mid-1971. The activities included the burial of small amounts of pesticides in small pits. The information about these activities is not well documented and the locations are vague. During the site visit, the field where the pesticides were reported to have been buried was covered in two feet of native grasses. However, there were several small areas, roughly two feet in diameter, that exhibited vegetative stress. The surface drainage is southward to a small pond.

Investigation

Soil/Sediment Samples. A total of four composite soil samples will be taken. These composite samples will consist of no more than six aliquots within a radius of one meter around the area of stressed vegetation. Aliquots will be taken from depths of 0-3 inches, homogenized in a stainless steel tray, and placed into sample jars.

Water Sample. One water sample will be taken from the small pond which drains the site.

Analytical Parameters. The four composite soil samples will be analyzed for herbicides, arsenic, and mercury. The water sample will be analyzed for pesticides, arsenic, mercury, and TDS.

2.5 OIL-SATURATED AREA (SITE 9)

Setting

The Oil-Saturated Area (Figure 2-1, Number 9) is identified as being located outside of Building 704. This is a maintenance and storage area that has been in operation since the mid-1950s. Through the years, oil has leaked onto the ground surface.

Investigation

Borings. One 15-foot soil boring is proposed for this site to identify the depth to which the oils have saturated the soil column. Three split-spoon samples will be taken.

Soil/Sediment Samples. Nine soil/sediment samples will be taken at this site: three from the borehole, and six composite surficial samples from the area draining the oil-saturated zone.

Water Samples. Two water samples will be taken: one from the borehole, should groundwater be encountered; and one from the surface water drainage pathway downgradient from the site.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons, lead, and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, lead, TDS, and volatile organics (EPA 601/602).

2.6 HAZARDOUS WASTE DRUM STORAGE AREA--BLDG. 923 (SITE 10)

Setting

The compound around Building 923 (Figure 2-1, Number 10) has been used as a repository for hazardous materials for an as-yet undetermined number of years. The compound is partially surfaced in asphalt and tarmac but the runoff from the stained area flows into a grassy drainage ditch. The handling and characterization of these drummed wastes is an ongoing operation. During the presurvey field visit, all of the drums were stored on wooden flats and categorized according to their contents. A drum overpacking operation was in progress in one of the Quonset huts in the compound. The area where the drums had been stored outside was noticably stained, indicating leakage from the drums. A list of the contents of 46 of the 69 barrels was prepared by General Testing Laboratories of Kansas City, Missouri, in January 1985. This report lists the pH, water miscibility, and flash points of the sampled barrels. The report was presented to E & E prior to the presurvey.

Investigation

Borings. One shallow soil boring will be drilled inside the compound near the stained area to determine if any hazardous compounds have migrated vertically in the soil column. The maximum depth of the borehole will be 15 feet. Three split-spoon samples will be taken from the boring.

Soil/Sediment Samples. Three soil samples will be collected from the borehole. Six surface soil samples will also be taken: one from the stained area, four downgradient, and one upgradient from the stained area.

Water Samples. Three water samples are planned: one from the shallow borehole, if groundwater is encountered; and two from the surface drainage pathway, one above and one below the stained area. The surface drainage way will be sampled if water exists during the fieldwork.

Analytical Parameters. The soil/sediment samples will be analyzed for EP toxicity metals, petroleum hydrocarbons, and volatile organics (EPA 8010/8020). The water samples will be analyzed for TDS, priority pollutant metals, volatile organics (EPA 601/602), petroleum hydrocarbons, barium, and mercury.

2.7 POL STORAGE AREA (SITE 12 [INCLUDES BLDG. 953])

Setting

The POL (fuel) storage area (Figure 2-1, Number 12) is a compound which includes three fuel storage tanks in bermed enclosures, underground pipes, and several pump houses. The incident involved with this facility is the release of some 3,000 gallons of JP4 fuel into one of the tank enclosures. The spill was cleaned, but there is a chance that fuel had leaked into the subsurface soils and may be contaminating a nearby creek. The compound is located in the north-central part of Richards-Gebaur AFB and is upgradient from the sewage treatment facility. The floor drains in one of the pumphouses also were noted as a potential discharge point for fuels to escape the facility.

Investigation

Borings. Because of safety and access problems, hand augers will be employed to sample the subsurface of the fuel spill in the storage tank enclosure. Three borings will be made and a maximum of three split-spoon samples collected from each boring.

Monitoring Well. A downgradient monitoring well will be completed outside the confines of the compound. Twenty linear feet have been allocated to complete this well.

Soil/Sediment Samples. A total of 11 soil/sediment samples are proposed: nine from the hand auger locations, and two near the outfall of drains from Building 953.

Water Samples. A total of four water samples are proposed: one from the monitoring well, two from the stream draining the POL tank area, and one from the drain outfall from Building 953.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and aromatic volatile organics (EPA 8020). The four water samples will be analyzed for petroleum hydrocarbons, TDS, and aromatic volatile organics (EPA 602).

3. FIELD SET-UP

Following approval of the proposed project plan, E & E will be responsible for ordering, acquiring, and mobilizing all required personnel and equipment to the facility.

The Air Force will be requested to supply a secure building on the facility to which equipment and supplies can be directly sent and stored prior to and during the project. This building will also be used as a central field and equipment maintenance office, and as a sample handling and storage area.

In addition to the building, a secure fenced-in area preferably adjacent to or near the building will be required for storage of the drilling rig and its equipment when not in use.

During the on-site work, equipment and supplies will be staged at the central location prior to being moved to the specific site under investigation. Following the day's activities, all equipment will be returned to the secured storage areas. No equipment will be left unattended at an investigation site.

The actual in-field set-up of equipment at an investigation site will follow E & E's established procedures. Figure 3-1 shows the basic concept of the standard field set-up. Site-specific considerations will probably necessitate some variations. All entry to an immediate work area will be controlled at all times during field activities in order to minimize the potential health and safety risk to both in-field personnel and any observers.

Prior to the start-up of work, a detailed work plan and a site safety plan will be prepared. The site safety plan will include the

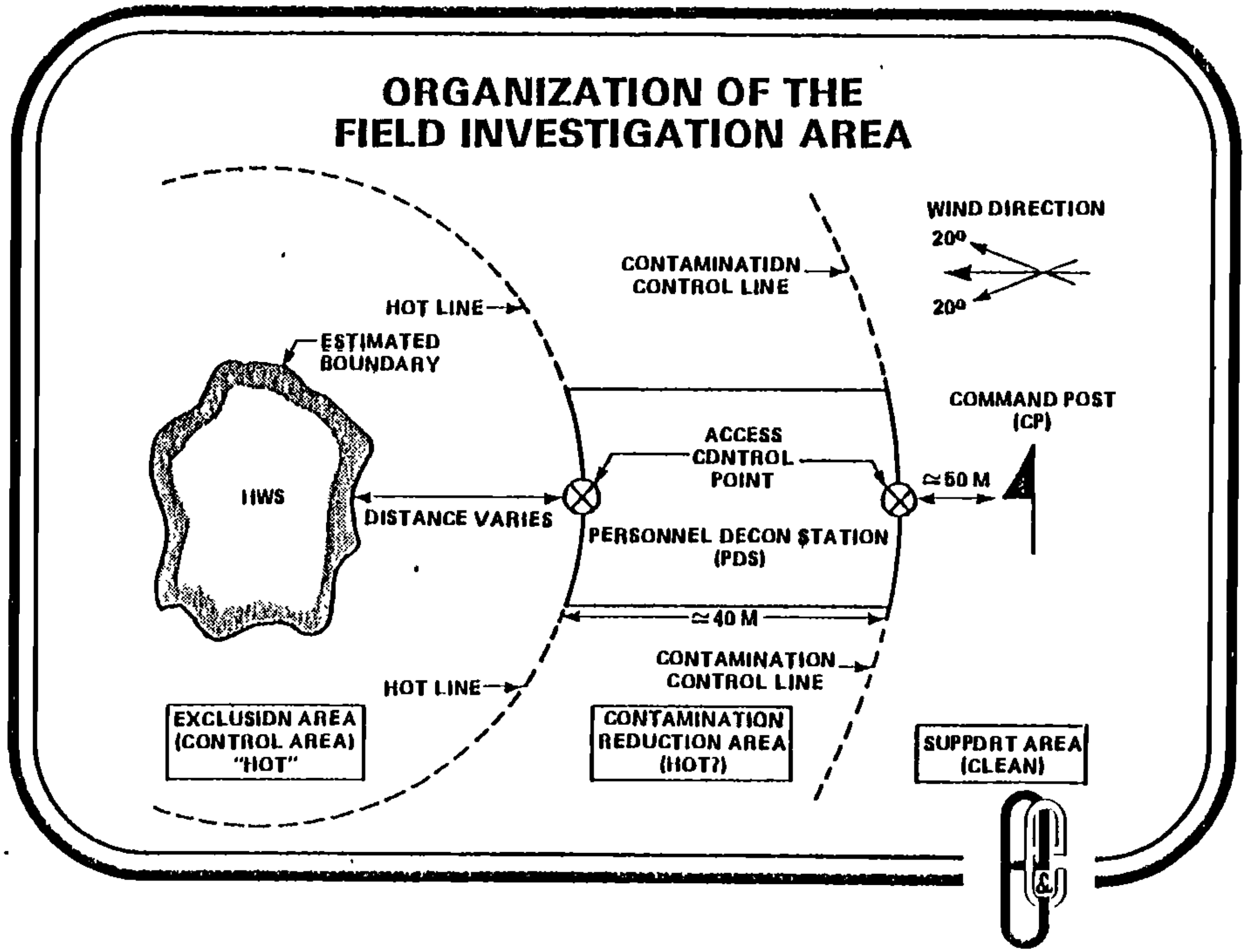

Figure 3–1 ORGANIZATION OF THE FIELD INVESTIGATION AREA

level of personal protection required by on-site personnel. Based on existing information concerning the sites at the facility, Level C presently is planned. However, if necessary, the site safety officer (see Section 15) may upgrade or downgrade the level of protection based on new or changing observations of site conditions. This would result in a cost increase or decrease, respectively. The Health and Safety Plan is presented in Appendix A.

E & E will utilize qualified local subcontractors to support the field investigation, as required. All subcontracted work will be overseen by the E & E project manager to insure compliance with the Statement of Work specified in the delivery order to the Phase II Survey of the IRP.

4. CALIBRATION OF FIELD EQUIPMENT

All field equipment should have been calibrated prior to delivery to the site. However, because of shock received during shipping and handling, the instruments may require either recalibration or an operational check prior to field use. The method and frequency of calibration for each instrument is generally based on such factors as the type of equipment, extent of use, degree of accuracy required, and manufacturer's specifications. Instrument calibration should be certified by documented standards of accuracy, whether performed at E & E headquarters or by outside calibration or repair services. E & E requires that records of calibration dates and standards be maintained for each instrument subject to calibration.

Each piece of equipment requiring periodic calibration or calibration prior to each use must be accompanied by a bound logbook. The logbook will note the instrument's current calibration status with regard to the date last calibrated, instrument settings during calibration, and the initials of the person performing the calibration.

All instruments are to be stored, transported, and handled with care to preserve the equipment's accuracy. Equipment found to be damaged prior to or during use must be taken out of service immediately and cannot be used again until a qualified technician repairs and recalibrates the equipment in question.

5. PREVENTATIVE MAINTENANCE OF FIELD EQUIPMENT

All equipment used by E & E in the field is subject to standard preventative maintenance schedules established by corporate equipment protocols. All equipment is inspected at least twice daily, once before start-up in the morning and again at the end of the work shift prior to overnight storage or return to the charging rack. Regular maintenance such as cleaning lenses, replacement of in-line filters, and removal of accumulated dust is to be conducted according to manufacturer's recommendations and in-field need, whichever is appropriate. All preventative maintenance performed will be entered in the individual equipment's logbook and the site safety logbook.

In addition to preventative maintenance procedures, daily calibration checks will be performed at least once a day in the morning prior to use and duly recorded in the respective logbooks. Additional calibration checks will be performed as required.

All logbooks will become part of either the permanent site file or the permanent equipment file.

6. FIELD ANALYTICAL PROCEDURES AND DATA REPORTING

All field analytical procedures and sampling at a facility or from the environment may become physical evidence in a legal action. An essential part of E & E's protocols is that the analysis or sample be controlled at all times and thoroughly documented. E & E maintains serialized field data records (FDRs) in the form of individual sheets or bound logbooks. Company analysts record all on-site measurements and field observations in the FDRs, including all pertinent information necessary to explain and reconstruct site operations. Each page of the FDR is dated and signed by all individuals making entries on that page. The leader of the field team on duty is responsible for insuring that the FDR is used during all activities and is stored safely to avoid possible tampering.

In addition to individual field sheets and daily logbooks, project managers must complete weekly summary sheets delineating the past week's activities. All data sheets, logbooks, and weekly summary sheets become part of the permanent site/project file. Figures 6-1 through 6-5 are examples of the weekly summary sheets that will be used.

6.1 CHEMICAL DATA

Chemical field analyses are generally limited to preliminary testing of pH and conductivity and surveying for organic vapors or other hazardous emissions (i.e., HCN, H_2S, and contaminated dust). All findings are recorded in the site logbook, site safety logbook,

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FIELD ACTIVITIES
WEEKLY PROGRESS REPORT

Work Site: ____________ E & E Job No.: ________ Week Ending: ________

Start Date: ____________ Percentage of Field Work Completed: ________

Client: ____________

Contractor(s): ____________

Personnel and Duties: ____________

Drilling:

Number of Holes Drilled: ________ Total Feet Drilled: ________ Average Feet/Day: ________

Material and Types of Equipment Used: ____________

Comments: ____________

Sampling:

Number of Samples Taken: ____ Water ____ Soil/Sediment ____ Average Samples/Day: ____

Materials and Types of Equipment Used: ____________

Comments: ____________

Other Field Activities:

Type of Work Performed: ____________

Comments: ____________

Future Work Plans: ____________

____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 447025

Figure 6—1 FIELD ACTIVITIES WEEKLY PROGRESS REPORT

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DRILLING
WEEKLY PROGRESS REPORT

Work Site: ______________ E & E Job No.: ________ Week Ending: ________

Driller: ____________ Driller's Helper: ____________ Geologist: ____________

Number of Drill Holes Drilled and Completed: ____________ Average Feet/Day: ________

Drill Hole Information:

1. Hole Designation: ________ Total Depth: ________ Static Water Level: ________

   How Hole was Drilled and Equipment Used: ____________

   Was Hole Cased? _____ Type and Amount of Casing Used: ________ Screened Interval: ______

   Type and Size of Well Screen: ____________

   Amount of Sand, Gravel or Cement Used: ____________

   Was Hole Developed? ____________

   Problems Encountered: ____________

2. Hole Designation: ________ Total Depth: ________ Static Water Level: ________

   How Hole was Drilled and Equipment Used: ____________

   Was Hole Cased? _____ Type and Amount of Casing Used: ________ Screened Interval: ______

   Type and Size of Well Screen: ____________

   Amount of Sand, Gravel or Cement Used: ____________

   Was Hole Developed? ____________

   Problems Encountered: ____________

3. Hole Designation: ________ Total Depth: ________ Static Water Level: ________

   How Hole was Drilled and Equipment Used: ____________

   Was Hole Cased? _____ Type and Amount of Casing Used: ________ Screened Interval: ______

   Type and Size of Well Screen: ____________

   Amount of Sand, Gravel or Cement Used: ____________

   Was Hole Developed? ____________

   Problems Encountered: ____________

____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 448025

Figure 6—2 DRILLING ACTIVITIES WEEKLY PROGRESS REPORT

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GEOPHYSICAL SURVEYS
WEEKLY PROGRESS REPORT

Work Site: ____________ E & E Job No.: ________ Week Ending: ________

Work Completed: ____________

Grid System Used (area covered, spacing and designation): ____________

EM Survey:

Type Equipment Used: ____________

Area Covered: ____________ Time (Hours) Required*: ________

Number of Data Points Collected: ________ Fullspace ________ Halfspace ________

Problem Areas: ____________

Comments: ____________

Magnetometer Survey:

Type Equipment Used: ____________

Area Covered: ____________ Time (Hours) Required*: ________

Number of Data Points Collected: ____________

Problem Areas: ____________

Comments: ____________

Seismic Survey:

Type Equipment Used (include number of channels): ____________

Area Covered: ____________ Time (Hours) Required*: ________

Number and Length of Lines Run: ____________

Problem Areas: ____________

Comments: ____________

Other Geophysical Work: ____________

*Total hours charged to project.

____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 446025

Figure 6—3 GEOPHYSICAL SURVEYS WEEKLY PROGRESS REPORT

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WATER SAMPLING
WEEKLY PROGRESS REPORT

Work Site: ______________ E & E Job No.: ________ Week Ending: ________

Total Number of Samples Taken: ______________ Average Samples/Day: ________

Procedures and Types of Equipment for Sampling: ______________

Comments: ______________

A. Sample I.D. and Location: ______________
Type of Sample: ______________
How Sample was Taken: ______________
Comments: ______________

B. Sample I.D. and Location: ______________
Type of Sample: ______________
How Sample was Taken: ______________
Comments: ______________

C. Sample I.D. and Location: ______________
Type of Sample: ______________
How Sample was Taken: ______________
Comments: ______________

D. Sample I.D. and Location: ______________
Type of Sample: ______________
How Sample was Taken: ______________
Comments: ______________

E. Sample I.D. and Location: ______________
Type of Sample: ______________
How Sample was Taken: ______________
Comments: ______________

F. Sample I.D. and Location: ______________
Type of Sample: ______________
How Sample was Taken: ______________
Comments: ______________

____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 444025

Figure 6—4 WATER SAMPLING WEEKLY PROGRESS REPORT

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SOIL/SEDIMENT SAMPLING
WEEKLY PROGRESS REPORT

Work Site: ______ E & E Job No.: ______ Week Ending: ______

Total Number of Samples Taken: ______ Average Samples/Day: ______

Procedures and Types of Equipment for Sampling: ______

Comments: ______

A. Sample I.D. and Location: ______
Type of Sample: ______
How Sample was Taken: ______
Comments: ______

B. Sample I.D. and Location: ______
Type of Sample: ______
How Sample was Taken: ______
Comments: ______

C. Sample I.D. and Location: ______
Type of Sample: ______
How Sample was Taken: ______
Comments: ______

D. Sample I.D. and Location: ______
Type of Sample: ______
How Sample was Taken: ______
Comments: ______

E. Sample I.D. and Location: ______
Type of Sample: ______
How Sample was Taken: ______
Comments: ______

F. Sample I.D. and Location: ______
Type of Sample: ______
How Sample was Taken: ______
Comments: ______

G. Sample I.D. and Location: ______
Type of Sample: ______
How Sample was Taken: ______
Comments: ______

______
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 445025

Figure 6–5 SOIL/SEDIMENT SAMPLING WEEKLY PROGRESS REPORT and field data sheets, if appropriate. Any further chemical analysis conducted in the field would be recorded using the procedures stated above.

6.2 HYDRAULIC DATA

Several techniques are employed in hydrological investigations. These may be employed separately or two or more may be combined, depending on the client's needs and the nature of a particular study. The contract scope of work normally details the procedures to be followed, describes the facilities, and identifies the equipment required to conduct the hydrologic investigations. The degree of calibration necessary and the exact method of documentation are site/project-specific.

Detailed procedures to be used in hydrologic studies during the Phase II Confirmation Study at this facility may include:

- Water sample collection, preparation, and shipment;
- Pump testing;
- Swabbing;
- Surging;
- Limited field analysis of groundwater samples; and
- Determination of water levels.

All data gathered during hydrologic investigations will be maintained in serialized field logbooks or on individual sheets as previously stated. Figures 6-6 through 6-9 are examples of field data sheets which may be used by E & E field personnel.

6.3 SOIL BORING DATA

For each boring and well installation, a field log must be completed by the geohydrologist supervising the operation. The completed log describes the operation, identifies any analyses conducted with findings, and provides a graphic description of the geohydrological environment encountered. The field logs become part of the permanent site file and must be kept in a secure location. Figures 6-10 and 6-11 are examples of the typical field log sheets used by E & E personnel.

DEPTH TO WATER

10 036

Well Name/Number ____________ Date ____________

Time (Military) #1 ________ #2 ________ #3 ________ #4 ________ (C.D.T.) (C.S.T.)

Name of Operator ____________

I.D. of Equipment (Vehicle or Iron Horse Number) ____________

Date of Last Calibration ____________ To be Calibrated (Date) ________

Correction Factor ____________ Measuring Point (MP) ____________

Land Surface Datum (LSD) to MP ____________ (Units)

Depth to Water (DTW) from MP (If measurement is within 0.1% of subsequent measurement, only 2 are necessary)

	#1	#2	#3	#4
In reading (1)				(Units)
Out reading				(Units)
Add or subtract (2) from Out reading				(Units)
Sum of (1) & (2)				(Units)
MP to LSD				(Units)
DTW from LSD				(Units)
Correction factors of equipment				(Units)
Corrected DTW from LSD				(Units)

Tool used to obtain DTW (float switch, magnesium (copper) screw, transducer -- if transducer, list range and serial number) ____________

Other equipment used (digital multimeter, recorder, etc.) List as appropriate
make ________ model ________ serial number ________

calibrated ____________ calibration date ____________

Procedure number used ____________

Altitude of MP ____________ (Units) Altitude of water level ____________ (Units)

Comments ____________

____

____

Figure 6—6 DEPTH TO WATER FIELD LOG SHEET

MONITORING EQUIPMENT

Well: ______________________

Date: ______________________

Time: ______________________ (Time Reference)

Name of Operator: ______________________

I.D. of logging equipment (vehicle) and/or cable reel No. ______________________

Serial Number of transducer: ______________________

Range of transducer: 0 to ______________________ (Units)

Calibration of transducer: ______________________ (mv/ft or mv/m)

Voltage to transducer (measured at power supply output with transducer attached): ______________________

Millivolts or volts as related to barometric pressure (i.e. barometric pressure may be 26.73 but is printed on data acquisition system as 2.67v. Therefore entry would be 2.67v = 26.73 inches of Mercury: ______________________

Other equipment used (type, Serial Number, when calibrated) ______________________

____

____

____

TRANSDUCER CALIBRATION POINTS

FT/M 1/	UP MV	MV Change 2/

1/ Indicate which units

2/ Per interval or per unit

Figure 6–7 MONITORING EQUIPMENT FIELD LOG SHEET

Pump Test

Sheet _1_ of _1_

Hole no ________ Test no. ________ Pump setting __________ft; Geologist/Engineer ____________

Cased interval __________ft; Perforated interval __________; Open hole ________ Diameter ______ in ___

Pump I.D, no. ________; Cable correction ________ft/ft; Measuring point is ______________

Date 19__	Hour (Military)	Elapsed time (minutes)		Water-level measurement (feet or meters)				Discharge (gpm)	Temp (°F)	Comments
		Pumping (t)	Recovery (t')	D/W Below MP	I.H. Cable correction	D/W Below LSD	Drawdraw			

Figure 6–8 PUMP TEST FIELD LOG SHEET

Swabbing-bailing test form ______ Hole ______ Area

Observed by. ______ Date: ______

Hole depth ______ diameter ______ Cased interval ______

Perforated intervals ______ Tested interval ______

Water levels measured with ______

Measuring point is ______ which is ______ below land surface.

Static water level ______ below measuring point.

BAILING TESTS

Type of bailer ______ length ______ diameter (ID) ______

capacity

SWABBING TESTS

Method of measurement (barrel, tank, etc.) ______

Tank dimensions: Width ______ length ______ height ______

Capacity: 1 = ______ 0.1 = ______ 0.01 = ______

Measuring point ______

______

Depth Casing set ______ Depth swabbing from ______

Weight of fluid at end of cleanout ______ ______ ft.

Time	Bailer or swab trip no.	Water removed	Depth to water below MP	t', time since discharge stopped	Remarks (temperature, color, specific conductance, etc. of sample)

Figure 6—9 SWABBING-BAILING TEST FIELD LOG SHEET

E & E Drilling and Testing Co., Inc.

FIELD LOG OF BORING
AND WELL INSTALLATION

PROJECT NUMBER AND NAME:	BORING/WELL No.:
PROJECT MANAGER: LOGGED BY:	SURFACE ELEVATION: DEPTH OF HOLE:
BORING DIAMETER: WELL DIAMETER:	CASING MATERIAL:
BORING METHOD:	FIELD CHEMIST:
HAMMER WT. (lbs):	DRILLER:
DROP (inches):	START TIME: COMPLETION TIME: DATE: DATE:

SAMPLING RECORD

SAMPLE NUMBER	SAMPLE INTERVAL	TYPE OF ANALYSIS			
		OVA	HNu	pH	Cond.

MATERIALS RECORD

DESCRIPTION	QUANTITY
TOTAL BORING (FT)	
TOTAL CORING (FT)	
NUMBER OF SPLIT SPOON SAMPLES	
TOTAL CASING (FT)	
TOTAL SCREEN (FT)	
NUMBER OF CAPS AND/OR PLUGS	
SAND-L.F. No.	
BENTONITE-L.F. No.	
CEMENT-L.F. No.	
SECURITY CAP (Y OR N)	
WELL DEVELOPMENT (Y OR N)	

LOCATION DIAGRAM:

Figure 6—10 FIELD LOG OF BORING AND WELL INSTALLATION (Form 1)

E & E Drilling and Testing Co., Inc.

FIELD LOG OF BORING
AND WELL INSTALLATION

DEPTH (FT)	GRAPHIC LOG	DEPTH TO WATER TABLE	SCREENED INTERVAL	BACKFILL MATERIAL	PROJECT NUMBER AND NAME:	BORING/WELL NO.:	SAMPLE NUMBER AND INTERVAL	BLOW COUNTS/6 IN.	DEPTH (FT)
					DESCRIPTION				

Figure 6–11 FIELD LOG OF BORING AND WELL INSTALLATION.
(Form 2)

6.4 SURVEY DATA

All site surveying will be recorded at the time of the work in either the site logbook or a separate bound logbook, and retained in the secured permanent site file. All entries will be made in ink, with errors indicated by a single line through the initial entry followed by the corrected entry and the initials of the person making the correction.

All surveying will be conducted to an accuracy of 0.01 feet $\pm$ 0.005 feet, thus enabling static water level measurements to be used to determine groundwater flow directions.

7. SAMPLE NUMBERING SYSTEM

7.1 PROJECT IDENTIFICATION

Project management is a complex and demanding process that requires an established framework to track a project's progress. E & E has established a Work Breakdown Structure (WBS) management plan which is at the heart of project cost control and tracks a project's progress through the identification of discrete tasks or elements, each with its own specific identification number. The overall project will have a six-digit alphanumeric code called the project number sequentially followed by specific task and subtask codes. All work performed or expenses incurred for the project will be attributed to one of the specific task or subtask codes, thereby enabling easy tracking of the project's progress and cost.

For this facility, specific task and subtask codes will be assigned for the different work segments (i.e., drilling of monitoring wells, sampling of groundwater, etc.) following approval of the work plan and receipt of an authorization to proceed from the Air Force.

7.2 SITE IDENTIFICATION

All environmental monitoring and sampling sites will be identified using the Air Force's standard format of a nine-digit, alphanumeric code consistent with that required for completion of AF Form 2752. The identifier will be made up of the installation code, followed by the sampling site type code and site location number. All documentation for a specific site will include the site identification code for ease of tracking.

7.3 SEQUENCE NUMBER

All samples collected during the project will be identified with an eight-digit alphanumeric code consistent with that required for completion of AF Form 2752. All documentation referencing samples taken will be identified using this system. The sample numbers will classify the sample as to the method and type of sample and the calendar year, and will sequentially identify each sample taken.

7.4 SPLIT SAMPLES

If required, sample splits will be obtained, one portion to be retained by the client and one portion to be sent to E & E's Analytical Services Center (ASC) for analysis. Identical sample numbers will be attached to the two (or more) containers and documented in the site logbook. All sample splits will be retained under standard chain-of-custody procedures until they are relinquished to authorized personnel.

7.5 FIELD QC SAMPLES

Additional samples taken in the field are used to evaluate both sampling and analytical methods. The three basic categories are blanks, duplicates, and spiked samples. Field spikes are rarely used because complicated manipulations of measured volumes of solutions are undesirable in the field. General criteria are that there will be one blank sample for each 20 field samples, or for each batch, whichever is smaller. Approximately one in 10 samples will be taken in duplicate. The actual quantities and types of QC samples will be decided by the project manager in consultation with the ASC manager. QC samples will be labelled, preserved, transported, and secured in exactly the same manner as samples (see Sections 12 and 13).

Field Blanks

Various types of blanks are used to check the cleanliness of field handling methods. Because field conditions cannot be as rigorously controlled as they are in the laboratory, positive field blank values are not to be subtracted from sample results. It is not possible to set rules for treatment of field blank results which show a degree of contamination. This is the responsibility of the project manager and the ASC manager, and they will decide to qualify or reject data taking into consideration all factors in a sampling and analysis project. It is possible to design blanks to monitor each and every stage of a sampling exercise: bottle cleaning, sample equipment cleaning, sample collection, transfer to bottles, bottle decontamination, packing, and shipping. Usually, only two types of blanks are used: the transport blank and the field equipment blank (sometimes called the transfer blank or rinsate blank). Field staff may add blanks if field circumstances are such that they consider normal procedures are not sufficient to prevent or control sample contamination, or at the direction of the project manager. Rigorous documentation of all blanks in the site logbooks is mandatory.

Transport Blanks

Transport blanks are blank samples designed to demonstrate that the transport of sample bottles to and from the field does not result in sample contamination. One of each type of the prepared bottles to be used during sample collection is filled with pure water, capped, and labelled. The project manager may or may not inform the laboratory that this sample is a blank. If the laboratory is not informed, it is permissible to put false identifying information on the label. If this is done, then the project manager must be responsible for preparation of the final report to the client or agency so that the information on that blank does not show up as a mysterious additional sample. Full documentation must be made in the site logbook.

The blank sample is transported to the site, unpacked, carried into the sampling area, labelled, decontaminated, packed, and shipped back to the laboratory. As far as possible, it should receive the same treatment as a real sample except that the bottle is not opened at any time.

Field Equipment Blanks

Field equipment blanks are blank samples (sometimes called transfer blanks or rinsate blanks) designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use, and that cleaning procedures between samples are sufficient to minimize cross contamination. If a sampling team is familiar with a particular site, they may be able to predict which areas or samples are likely to have the highest concentration of contaminants. Unless other constraints apply, these samples should be taken last to avoid excessive contamination of sampling equipment.

Field equipment blanks can be taken before the sampling apparatus is used to collect any samples at the beginning of the day. In this case, the blanks are used to test the initial preparation of the sampling apparatus. The sampler (bailer, split spoon, coliwasa, etc.) is rinsed with pure water (or, in some cases, solvent) and the rinsate is collected and treated as any other sample. Alternatively, or in addition, field equipment blanks can be taken during a sampling run, in which case they serve to test the efficiency of the field cleaning procedures used to prevent cross contamination. The equipment is cleaned in the recommended way, then rinsed with water (or solvent), which is then collected. In either case, it is the responsibility of the project manager and the ASC manager to interpret the results and reject or qualify data accordingly.

Duplicate Samples

Approximately one in 10 samples will be taken in duplicate. Duplicate samples are identical samples (same place and time, or immediately consecutive) placed in identical containers and treated as normal samples. For the purpose of data reporting, one is arbitrarily designated the sample, the other as the duplicate. Both sets of results are reported (not averaged) to give an indication of the precision of the sampling and analytical methods.

The project manager decides which samples are to be duplicated and whether or not to inform the laboratory. If the project manager wishes to make an assessment of the laboratory's precision without the laboratory's knowledge, the duplicate sample can either be labelled simply "duplicate" or with some false identifying information (e.g., a non-existent monitoring well identification number). In this case it is the project manager's responsibility to assess data quality on the basis of the duplicate results.

10 047

8. DRILLING AND INSTALLATION OF GROUNDWATER MONITORING WELLS

8.1 DRILLING

E & E employs a wide range of soil and rock boring techniques, including those using drive casing; both solid- and hollow-stem augers; water, air, and mud rotary and reverse rotary drills; and cable tools. The data requirements for a given well dictate the size and depth of the well, the materials to be used in its construction, and, ultimately, the method of its installation. Table 8-1 lists some available drilling methods and their limitations.

E & E's approach to well drilling and boring design will depend on the specific nature of the past operation, the present data needs, the current environmental setting at each site, and any projected remedial actions. The drilling program will have detailed specifications of procedures and techniques for well and boring location, type, and design; sample collection, preservation, and transportation; analytical procedures; and chain-of-custody control. The use of such specifications will avoid the "hit-or-miss" approach that is typical of less sophisticated programs and will eliminate hidden costs.

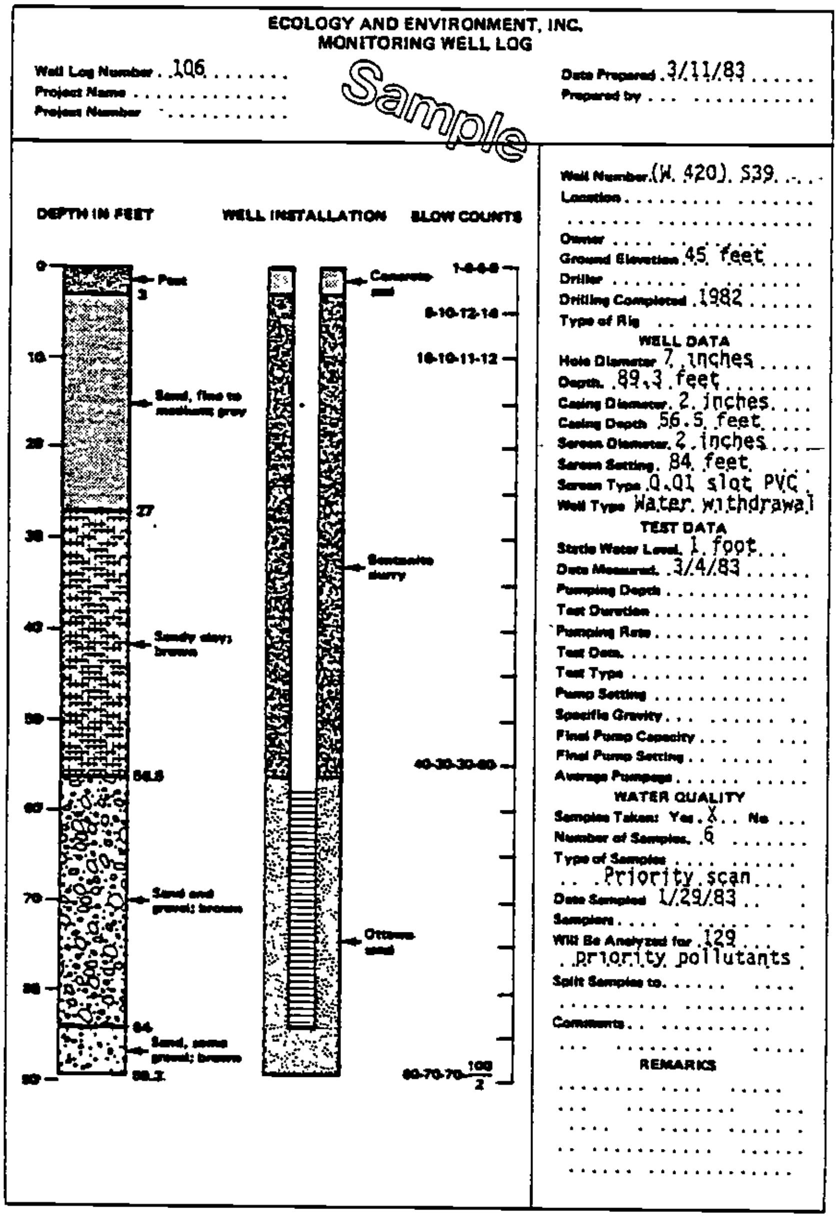
Soil samples will be taken every 5 feet (unless otherwise specified by the Air Force) and at every change in strata by driving a 2-inch outside diameter, 2-foot-long split-spoon sampler. Samples will be inspected in the field by a qualified hydrogeologist who will establish site stratigraphy and geologic trends. All field data will be documented in a well log (Figure 8-1) that will be presented to the Air Force. The driller will be required to keep a similar log to serve as a cross-check of the accuracy of the field notes. Representative portions of each sample will be retained in labeled jars.

Table 8-1

SOME AVAILABLE DRILLING METHODS AND THEIR LIMITATIONS

Method	Assets and Limitations
Drive casing	Inexpensive and excellent for shallow, small-diameter wells. Vertical samples can be obtained by split-spoon and Shelby tube samplers with relative ease. Equipment is mobile and can be moved to virtually any location. Equipment can be obtained with coring capabilities. However, the method is relatively slow and is limited to about 100 to 150 feet in depth. A supply of drilling water is necessary. This water is introduced into the boring, thus creating potential cross-contamination or dilution problems. Trouble can be encountered with boulders and coarse gravel.
Hollow-stem auger	Inexpensive and particularly well-suited to shallow wells in unconsolidated formations. Drill rigs are highly mobile and easy to set up. No drilling fluid or washwater is required. Soil and water samples and bedrock cores can be taken through hollow-stem rigs. However, drilling depths are limited to 100 to 150 feet--often less in tight formations or coarse gravels. If boulders are encountered, it is usually necessary to abandon the hole.
Hydraulic rotary	Fast and well-suited to drilling larger-diameter wells in consolidated and unconsolidated formations. Much greater depths can be attained by this method. Core samples can be collected. The chief drawbacks are the expense, complexity of equipment operation, and difficulty in obtaining undisturbed soil samples. In addition, a supply of drilling water is necessary. This water is introduced into the boring, thus creating potential cross-contamination or dilution problems.
Air rotary	Similar to the hydraulic rotary, this method has the added advantage of not having to use drilling fluids while offering the versatility of being able to use a conventional roller cone bit and mud pump. Air rotary is probably the fastest drilling method available. However, the borehole size generally is limited to eight inches.
Cable tool	Relatively simple to operate and can be employed to drill large-diameter wells in consolidated and unconsolidated formations. Core samples can be collected. However, tends to be slow and drilling water may dilute formation water.

10 049


ECOLOGY AND ENVIRONMENT, INC.
MONITORING WELL LOG

Well Log Number . . 106 . . . .
Project Name . . . .
Project Number . . . .

Sample

Date Prepared . 3/11/83 . . . . . .
Prepared by . . . .

Well Number (W. 420). S39. . . .
Location . . . .
Owner . . . .
Ground Elevation 45 feet . . . .
Driller . . . .
Drilling Completed . 1982 . . . . .
Type of Rig . . . .

WELL DATA

Hole Diameter 7 inches . . . . .
Depth . 89.3 feet . . . .
Casing Diameter . 2 inches . . . .
Casing Depth 56.5 feet . . . .
Screen Diameter . 2 inches . . .
Screen Setting . 84 feet . . . .
Screen Type . 0.01 slot PVC .
Well Type Water withdrawal

TEST DATA

Static Water Level . 1 foot . . .
Date Measured . 3/4/83 . . . . .
Pumping Depth . . . .
Test Duration . . . .
Pumping Rate . . . .
Test Date . . . .
Test Type . . . .
Pump Setting . . . .
Specific Gravity . . . .
Final Pump Capacity . . . .
Final Pump Setting . . . .
Average Pumpage . . . .

WATER QUALITY

Samples Taken: Yes . X . . No . . .
Number of Samples . 6 . . . . .
Type of Samples . . . .
. . . Priority scan . . . .
Date Sampled 1/29/83 . . .
Samplers . . . .
Will Be Analyzed for . 129 . . . .
. . priority pollutants .
Split Samples to . . . .
Comments . . . .

REMARKS

Figure 8–1 SAMPLE MONITORING WELL LOG

Bedrock cores are obtained by the use of diamond-tipped core barrels. All cores will be retained for future study, which may include microscopic examination of rock thin sections under a petrographic microscope to determine rock type, extent of microfracturing, and the like. Knowledge of these properties could aid team hydrogeologists in assessing the likelihood of the bedrock regime's acting as a conduit for off-site migration of contaminants. All drilling and boring will be conducted with strict adherence to ASTM standards, if applicable.

If drilling is conducted in areas suspected of being contaminated by volatile organics, samples of drilling spoils will be collected and placed in 50-mL vials with Teflon-coated septa. "Head-space" samples will be withdrawn and field-screened, using a Century Model 128 OVA, to estimate total volatile organic contamination. These data subsequently will be used to help delineate the vertical extent of contamination, establish the interval over which the well will be screened, and help characterize the contamination in order to determine the level of respiratory protection required on-site.

Stringent safety regulations will be adhered to by all E & E personnel and subcontractors. An in-depth description of the E & E corporate health and safety program, which will be followed by personnel working on Air Force projects, can be provided upon request.

8.2 SOIL SAMPLING

Soil samples will be taken at 5-foot intervals or, if warranted, on a continuous basis using split-spoon samplers. Shelby tube samples of undisturbed soil will be obtained for laboratory analysis of parameters such as hydraulic conductivity, shearing strength, and porosity. Bedrock will be obtained using diamond-tipped core barrels. The bedrock cores may be taken to the depth at which the well will be screened.

As soil samples are taken from the split spoon, an OVA will be used to "sniff" them for the presence of organic vapors. Samples will be forwarded to E & E's ASC for additional evaluation, either as composite or discrete samples.

All soils will be classified on-site by a geologist using the Unified Soil Classification Scheme.

Each containerized soil sample to be used in a composite will be sieved through a No. 8 mesh screen to remove stones and debris. Screening will be accomplished using a Teflon scraper to force material through the screen. This insures that the sample weight is not distorted by stones and debris with respect to any compound that may be present. The screened sample will then be weighed and returned to its original container for storage until all soil samples have been screened. The weight of the screened samples will be recorded for future use.

A portion of each screened sample will then be weighed to provide equal portions for the homogenization step. The weighed portions will be mixed thoroughly in a prepared 16-ounce sample bottle using a spatula. A homogeneous mixture will be attained by stirring the sample at least 10 to 15 times. The mixed sample will then be placed on a Teflon sheet and shaped into a rectangular form of even thickness. The rectangle will then be quartered: two diagonal quarters will be combined as the client composite; the alternate diagonal quarters will be combined as a storage composite. For storage, the composites will be placed in prepared containers, sealed, and accompanied by appropriate sample control records. The storage composites will be held at the ASC in a secured storage area until the project is complete.

The soil composites for volatile organic analysis will be prepared in the following manner. During field operations, a portion of each soil sample will be placed in a 40-mL borosilicate vial. Equal portions of soil will be removed from each vial and placed in the composite vial. The composite samples will then be mixed quickly and the vial sealed.

More detailed soil contamination data will be required if soils contaminated with hazardous materials are to be excavated and removed to approved disposal facilities. For this type of investigation, the surface of the disposal site will be surveyed and gridded into areas of approximately 1,000 square feet. (Grid size may vary, depending on the nature of the site and underlying soils.) A borehole will be installed at the center of each grid square; soil samples will be taken at the ground surface and at 5-foot intervals until the appropriate depth has been reached. This depth may vary from as little as 5 feet in areas underlain by compact clays to as much as 100 feet in areas underlain by coarse sand and gravel. The result of this type of study is a three-dimensional representation of the soil beneath the site to the appropriate depth, with contaminant data for each block.

Surface water drainage channel soil samples will be taken to a depth of 12 inches, typically at 50-foot intervals, to a distance of 150 feet from the site boundary alonq each channel.

8.3 MONITORING WELL CONSTRUCTION AND COMPLETION

Upon completion of the borehole, team hydrogeologists will supervise the installation of the monitoring well(s). The type of materials used in well construction will vary according to data requirements. For example, in a shallow, unconsolidated glacial aquifer contaminated by volatile organic contaminants, the project team normally would specify 2-inch diameter PVC pipe with threaded joints. If contamination by certain ketones or aromatic compounds is suspected, it may be necessary to specify stainless steel casing in order to eliminate potential chemical reactions that could occur if PVC were used. A Johnson-Keck submersible pump would be specified for purging and a Teflon bailer would be specified for sampling. Other variables could include the length of well screen, screen slot size, type of backfill to be used, type and lenqth of seal or grout, and type of well security to be used. All variables will be considered carefully and the best design for the job will be presented to the USAF-OEHL project engineer for approval.

Figure 8-2 shows three alternative types of monitoring wells, each designed to address a different set of data requirements:

- Fully screened wells are used to enable the hydrogeologist to obtain a composite sample of groundwater to establish compliance points and detect the presence of any aquifer contamination. Their use also is recommended in conducting pumping tests to obtain accurate measurements of aquifer response.

- Bedrock wells enable selective sampling of the bedrock aquifer in order to measure groundwater quality and to evaluate the interaction between bedrock and unconsolidated aquifers.

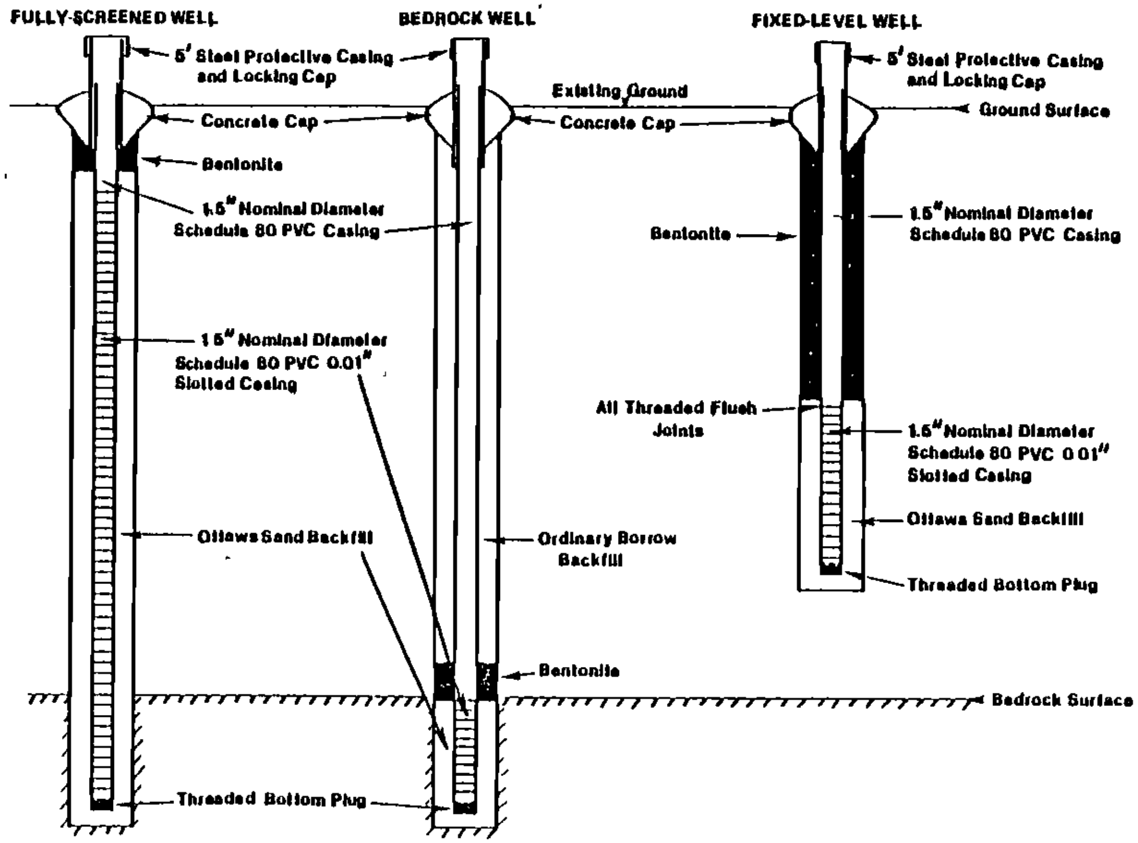


Figure 8–2 TYPICAL DETAIL OF MONITORING WELLS

- Fixed-level wells are utilized to take isolated samples from individual strata suspected of containing contaminated groundwater. These wells also can provide an early warning system to detect the movement of contamination into isolated, pollutant-free aquifers. Great care will be taken to preclude the possibility of cross-contamination of aquifers by carefully reviewing geologic and geophysical data, conducting field analyses of soil samples for contamination, and the placing of grouting material at confining layers.

When drilling in a potentially contaminated environment, it will be necessary to collect and dispose of drilling spoils and washwater and to dispose of or properly decontaminate protective equipment. Furthermore, to prevent cross-contamination between wells, it will be imperative to decontaminate all drilling equipment between wells (see Section 11.1). This may necessitate steam cleaning the equipment, rinsing it with a solvent, and then subjecting it to a second steam cleaning. Subject to all pertinent local, state, and federal regulations, decontamination wastes will be containerized and all contaminated wastes generated on-site subsequently will be removed to an approved disposal facility by a licensed hazardous waste hauler.

Unless otherwise specified, E & E will design all wells as permanent sampling locations. Therefore, care will be taken to locate the wells so that they may be incorporated into future monitoring and remedial operations. Concrete caps and protective, lockable steel casings will be installed around each well, thus reducing the possibility of vandalism while insuring sample integrity.

All well casing top elevations will be surveyed to an accuracy of ± 0.01 feet, thus enabling static water level measurements to be used to determine groundwater flow directions.

All drilling operations, installation procedures, sampling data, and waste disposal operations will be fully documented in bound field books to assure that the highest degree of care has been taken in completing all required work.

8.4 WELL DEVELOPMENT

At least 48 hours after internal mortar placement, the monitoring wells will be developed according to procedures prescribed below. Well development will be conducted using either a submersible pump, airlift methods, or a bottom discharge bailer, with or without a surge block. The wells will be drilled without the use of drilling fluid and a minimum of five times the amount of the standing water volume in the well, including the well screen, casing, and saturated annulus (assuming 30% porosity), will be removed. Wells will be developed until the well water is clear to the unaided eye, the sediment thickness remaining in the well is less than 5% of the screen length, and the five well volumes (described above) have been removed.

Well development also will include washing the entire well cap and the interior of the well casing above the water table using only water from that well. The result of this operation will be a well casing that is free of extraneous material (grout, bentonite, sand, etc.) inside the riser, well cap, and blank casing between the top of the well casing and the water table. This washing will be conducted before and/or during development, not after development.

The following data will be recorded as part of well development:

- Well designation;
- Date(s) of well installation;
- Date(s) and time of well development;
- Static water level from top of well casing before 24 hours after development;
- Quantity of water lost:
  - During drilling and
  - During fluid purging;

- Quantity of fluid in well prior to development
  - Static water level and
  - Contained in saturated annulus;
- Field measurement of pH before, twice during, and after development;
- Field measurement of specific conductance before, twice during, and after development;
- Depth from top of well casing to bottom of well (from diagram);
- Screen length (from diagram);
- Depth from top of well casing to top of sediment inside well, before and after development;
- Physical characteristics of removed water, including changes during development in clarity, color, and particulates;
- Type and size/capacity of pump and/or bailer used;
- Description of surge technique, if used;
- Height of well casing above ground surface; and
- Quantity of fluid/water removed and time of removal.

The water removed from a well during development will be stored on-site in bulk containers or drums for proper disposal if the water is contaminated.

8.5 GEOPHYSICAL LOGGING

All boreholes for monitoring wells will be geophysically logged for the purpose of cataloging and correlating lithology and stratigraphy. Because the boreholes will be drilled without the use of drilling fluids, it is recommended that calibrated nuclear logs, such as neutron and gamma-gamma, along with natural gamma logs, be used. Electric logs, such as spontaneous potential and resistivity, cannot be run due to the lack of drilling mud and, although there may be some water in the drill hole, it is not anticipated that the water height will be sufficient to allow meaningful surveys to be performed. Nuclear logs will supply information pertaining to lithology, stratigraphy, total porosity or bulk density, and moisture content. The advantage of these logs is that they can be used in either cased or uncased boreholes. As a cost-saving benefit, E & E recommends that all geophysical logging be performed upon completion of all well construction, to minimize standby costs.

Table 8-2 contains a summary of log applications that may be used for this project, and the types of information that may be obtained from each.

Table 8-2

SUMMARY OF LOG APPLICATIONS

Required Information	Widely Available Logging Techniques that Might be Used
Lithology and stratigraphic correlation of aquifers and associated rocks	Electric, sonic, and caliper logs in open holes; nuclear logs in open or cased holes
Total porosity or bulk density	Calibrated sonic logs in open holes; calibrated neutron and gamma-gamma logs in open or cased holes
Location of water level or saturated zones	Electric, temperature, and fluid conductivity in open holes or inside casings; neutron and gamma-gamma logs in open holes or outside casings

9. AQUIFER TESTING

The movement of groundwater and any associated contaminant plume through an aquifer is controlled by the physical characteristics of the medium and the hydraulic head gradient. Changes in the potentiometric surface caused by the pumping of local wells can be evaluated to determine formation permeabilities, specific yield, drawdown, and extent of cones of depression. All of these properties are important in assessing the potential impact of a contaminant plume on local groundwater quality. Artificial changes in the hydraulic head caused by withdrawing water from the aquifer can locally distort the potentiometric surface and alter the flow direction of a contaminant plume. Proper placement of a pumping well may locally lower the water table, effectively isolating a potential source of contamination from contact with the groundwater. A pumping well situated in a contaminant plume can be incorporated into a remedial action plan to remove the contaminated water for treatment purposes. A pumping well also can be used as a diagnostic tool to determine the hydraulic connection between adjacent aquifers in order to aid in the siting of proposed landfills, lagoons, and waste storage sites.

By interpreting the aquifer response to any of a variety of field tests, E & E hydrogeologists infer data pertaining to transmissivity, storativity, and boundary conditions, as well as data pertinent to the movement and extent of contaminant plumes.

Existing wells will be used whenever possible to reduce project costs. Generally, a well diameter of at least four inches will be needed. Three or more observation wells usually will be specified.

The wells will provide the water table data for varying distances from the pumping well, which will be used to determine the size and shape of the cone of depression and the aquifer transmissivity.

E & E will supervise the design and installation of suitable wells. Pumping wells will be of sufficient size to accommodate standard submersible pumps and generally will be screened over the entire saturated thickness of the aquifer. Observation wells will be sited to provide the data thought to be necessary and will be screened in the proper strata to accurately gage the aquifer response to pumping.

Normally, a pumping test will be conducted as a 72-hour step-drawdown test. E & E personnel will monitor the wells for the full duration of the test (discharge rates will be measured by a free discharge pipe orifice or by a commercially available flow meter). Hydrogeologists will evaluate the data using type curves for both time-drawdown and distance-drawdown solutions. The methodologies pioneered by C.V. Theis in 1935 will be used to analyze confined aquifer situations; the methodologies developed by S.P. Neuman in 1975 will be used to analyze unconfined aquifer systems.

When pumping tests are conducted in contaminated environments, periodic sampling will be conducted to enable E & E hydrogeologists to assess changes in pollutant content and to determine the effects of pumpage on the contaminant plume. The discharge of contaminated groundwater generated by a pumping test may need to be contained or may require a National/State Pollutant Discharge Elimination System permit from the appropriate regulatory agency if it is discharged to a sewer or to a body of surface water. E & E will assist in the acquisition of any required permits.

On a smaller scale, individual piezometer wells can be used to conduct in-situ permeability tests. Such tests involve creating an instantaneous head change in the piezometer and then recording head recovery versus time as the water level gradually returns to its static condition. In-situ permeability tests are of two types: "slug" tests, in which a volume of water is instantaneously added, and "bail" or "pump" tests, in which a volume of water is instantaneously removed. The method that E & E most commonly uses to interpret these data and derive a permeability number is the method of Hvorslev*, which uses time/head-change data to graphically calculate a factor, T_0, "basic time lag." Then, for a piezometer screen length of L, a sandpack radius of R, and a well casing radius of r, the permeability, K, is defined as:

$$K = \frac{r^2 \ln (L/R)}{2L\ T_0}$$

The computation of K for each piezometer allows a hydrogeologist to compute the actual rate at which the groundwater (and thus contaminants) leaves the site by applying the following version of the common Darcy equation for groundwater flow:

$$Q = KiA,$$

where Q is groundwater discharge; K is permeability; i is hydraulic gradient (derived from piezometer water levels); and A is cross-sectional area perpendicular to flow.

A typical aquifer test will include collection of background data for siting purposes, installation of a discharge well and three observation wells, monitoring to establish background conditions, performance of a 72-hour pump test, and interpretation of the results.

*Hvorslev, M.J., 1951, "Time Lag and Soil Permeability in Groundwater Observations," United States Army Corps of Engineers, Waterways Experiment Station Bulletin 36, Vicksburg, Mississippi.

10. GROUNOWATER MONITORING AND SAMPLING

10.1 GROUNDWATER LEVEL MEASUREMENT

Water levels will be measured at all monitoring wells and surface water staff gaging stations on a monthly basis. Work will be performed in accordance with established safety requirements by either contractor or subcontractor personnel. All measurements will be taken to within 0.01 foot.

The top of the interior casing of all monitoring wells will be marked at one point, which will be surveyed to determine its elevation. The depth of the water table below the top of the casing will be determined by a steel tape or electric water level indicator. All equipment will be decontaminated between wells to prevent cross- contamination.

10.2 SURVEYING OF WELLS

Following completion of the installation of the final well, each installed well location will be surveyed to determine map coordinates (Univeral Transverse Mercator, State Planar, or latitude/longitude) to within one meter and entered onto a site map. Elevations of both the ground surface and the top of the well riser will be surveyed to within 0.01 foot (± 0.005 foot if possible) using the National Geodata Vertical Datum of 1929. These data will become part of the permanent site file.

10.3 ON-SITE ANALYSIS

Groundwater sampling and analysis will involve the following steps:

- Measurement of the static water level;
- Purging of several well volumes;
- Acquisition of the sample;
- On-site analysis; and
- Off-site analysis (see Section 10.4).

Before any water is drawn from a well, the static water level depth from the top of the casing is measured, then the well is purged. If the well can be completely dewatered, the purging process consists of removing a volume equivalent to twice the volume of the standing water originally contained within the monitoring well plus the surrounding sand or gravel pack, if present. If the well cannot be dewatered (because the specific yield is relatively large), the purging consists of the removal of at least five standing volumes (possibly more, depending on the results of pH and specific conductivity testing conducted on the purge water in time series). The values are time plotted and the purging process is considered complete when the values have stabilized. In most cases, a submersible pump is used to accomplish this purging. The most versatile pump of this type is the small-diameter stainless steel Johnson-Keck pump, which is battery operated and small enough to fit into two-inch diameter wells.

To avoid sample cross-contamination, E & E uses bailers constructed of Teflon, PVC, or stainless steel. Each bailer is thoroughly decontaminated before it is used in the next well. Bailer size depends on the requirements of each project. The bailers are constructed of Teflon-extruded, heavy wall tubing and are plugged at the bottom with a short length of Teflon-extruded rod (no glue is used). Water enters the bailer both from the open top and from the bottom through a 3/4-inch hole. It is prevented from flowing out of the hole by a one-inch glass marble, which rests in a conical seat machined into the top of the plug.

On-site analysis is generally restricted to pH, conductivity, and surveys for organic vapors. pH and conductivity are routinely checked during purging operations to determine steady-state conditions between the water within the well column and the existing groundwater. In areas of potential contamination, a flame ionization or photoionization instrument is routinely used to survey the groundwater during purging and the water samples for organic vapors in order to determine the potential health hazards.

10.4 SAMPLING FOR OFF-SITE ANALYSIS

Sampling of groundwater for off-site analysis is conducted in the same manner as sampling for on-site analysis as described in Section 10.3, with the addition that the water samples are containerized and shipped to an outside laboratory for analysis as described in Sections 12 and 13.

11. DECONTAMINATION PROCEDURES

Decontamination of personnel and equipment is an important element of site safety operations. Proper decontamination prevents sample cross-contamination and contamination of personnel, vehicles, and the public; moreover, it supports quality control. Decontamination at the site involves the use of field decontamination stations for personnel, equipment, and clothing.

The decontamination process is designed to control the spread of contaminants to clean areas by physically removing or chemically neutralizing the contaminants. The following subsections delineate the basic decontamination processes for various pieces of field equipment and describe a sample personnel decontamination set-up for a Level B or C site. The actual decontamination layout is generally site-specific but would include most, if not all, of the described stations. A Level D site would involve less protective clothing and fewer stations.

Decontamination procedures normally take place in the contamination reduction area (see Figure 11-1). In this area, all equipment which entered the site is cleaned prior to moving off-site and outside of the contamination control line. Table 11-1 identifies various decontamination wash solutions which can be used depending on the site-specific hazards encountered.

11.1 DRILLING, SOIL SAMPLING, AND MONITORING WELL INSTALLATION

Prior to use in the field, and between sampling locations, all equipment, including the full auger rig and all auger flights, will be

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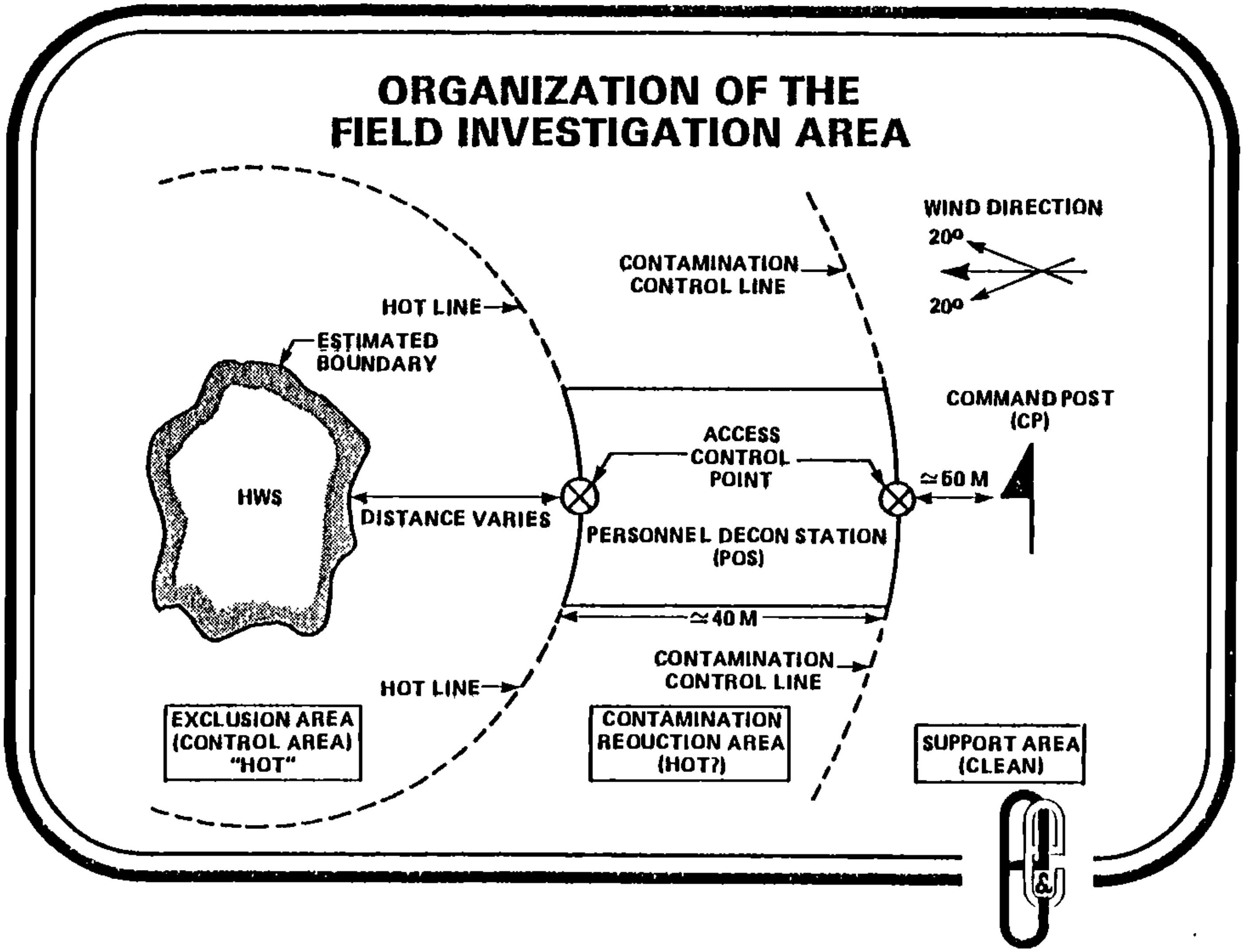

Figure 11–1 ORGANIZATION OF THE FIELD INVESTIGATION AREA

Table 11-1

USE OF GENERAL PURPOSE DECONTAMINATION SOLUTIONS

Decon Solution	Mixing Solutions	Uses/Remarks
A. An aqueous solution containing a low-sudsing detergent	Follow the mixing instructions written on the particular product label	Generally has the widest range of use; best choice on sites where contaminant is unknown or a wide range of contaminants exists
B. An aqueous solution containing 5% sodium carbonate (Na_2CO_3) washing soda	To 10 gallons of water, add four pounds of sodium carbonate	Decon solution of choice for base labile compounds such as the organophosphate pesticides; effective in neutralizing inorganic acids; since sodium carbonate is a water softening agent, this characteristic is an aid in physical removal of contaminants.
C. An aqueous solution containing 5% sodium bicarbonate ($NaHCO_3$) baking soda	To 10 gallons of water, add four pounds of sodium bicarbonate	Sodium bicarbonate is amphoteric and can be used to neutralize either base or acid contaminants; good decon for base labile compounds
D. An aqueous solution containing 2% trisodium phosphate (Na_3PO_4) (TSP)	To 10 gallons of water, add approximately two pounds of trisodium phosphate	See uses/remarks for decon solution B above
E. An aqueous solution containing 10% calcium hypochlorite ($CaCl_2O_2$) (HTH)	To 10 gallons of water, add eight pounds of calcium hypochlorite	Cyanide salts
F. Ethylenediaminetetra-acetic acid (EDTA, versene, sesquestrene)	Commercial product; follow product label	EDTA is a chelating agent and is the decon solution of choice for heavy metal contaminants
G. An aqueous solution containing 3 to 5% citric, tartaric, oxalic acids or their respective sodium salts	To 10 gallons of water, add four pounds citric, tartaric, or oxalic acid	These compounds are chelating agents and are the decon solution of choice for heavy metal contaminants

decontaminated using the following cleaning procedures. At least 200 feet of auger will be dedicated to the rig prior to the initiation of drilling. Drilling will be carried out on a plastic tarp pad, nominally 20 by 20 feet. Drill cuttings will be collected on the pad during drilling. Once a hole has been completed, the used augers will be fully cleaned on the pad and the washings will be collected in the cuttings on the pad. The cleaned augers will be returned to the working rig.

The equipment washing procedure is as follows:

- The auger flight will be steam-cleaned.
- The auger flight will be fully rinsed with methanol, an organic solvent that is easily volatilized, is not a priority pollutant, and therefore cannot introduce extraneous contamination to the site.
- The auger will be thoroughly rinsed with distilled water and allowed to air-dry.

All soil sampling equipment including split spoons, stainless steel spatulas, screens, and pans will be decontaminated by washing in laboratory-grade detergent, rinsing three times with tap water, rinsing with either pesticide-grade acetone or methanol, and then rinsing with ASTM Type I water. The equipment will be air-dried prior to repeated use. If weather conditions or other factors prohibit air-drying, the equipment will be dried in an oven at 105°C for 15 minutes and allowed to return to room temperature prior to use.

11.2 WELL DEVELOPMENT AND AQUIFER TESTING

All equipment used during well development and aquifer testing will either be cleaned/decontaminated or new prior to placement into the well. Equipment such as submersible pumps will be thoroughly decontaminated using the procedures identified in Section 11.1 Several items such as monofilament line, rope, and tubing purchased new will be rinsed with ASTM Type I water.

Following completion of well development and aquifer testing at each well, the equipment removed from the well will be considered as contaminated and subject to the same decontamination process or discarded prior to use in another well.

11.3 WATER LEVEL MEASUREMENTS

Water level measurements will generally be taken using a steel tape or electronic water level indicator. All equipment entering the well will be washed and rinsed prior to insertion into the well according to the procedures specified in Section 11.1. Upon completion of the measurement at each well, the equipment will be subjected to the same decontamination process prior to use on any additional wells in order to prevent cross-contamination.

11.4 WATER SAMPLING

Water sampling equipment (pumps, bailers, glass sampling jars, etc.) will be cleaned prior to use in any sampling work according to the procedures described in Section 11.1. Following completion of sampling at a specific point, all equipment will be subjected to the same decontamination process to prevent cross-contamination between sampling points.

11.5 SEDIMENT SAMPLING

Sediment sampling equipment such as stainless steel scoops, sieves, augers, split spoons, and dredges will be subjected to the same decontamination procedures as other field equipment both prior to and immediately following use at each sampling site.

11.6 PERSONNEL DECONTAMINATION

Avoidance of contamination is the first and best method for preventing the spread of contamination from a hazardous site. Every effort should be made to prevent direct contact with the contaminant. Careful planning, knowledge of the contaminant, and attention to where one puts one's hands and feet are all important. Simple common-sense rules of contamination avoidance include not sitting down, not leaning against drums or debris, and not putting equipment on the ground.

No one should enter a site alone, though all tasks should be accomplished with as few team members as possible. Thus, exposure is limited to a minimum number of team members, and the ultimate process of decontamination is simplified.

The first step in the decontamination process may well take place while the team is still on or just off the hazardous site but still in the exclusion area. This is especially true if there is known heavy ground contamination. In areas of spills or heavy leachate runoff, the protective boots will become heavily contaminated. As the team leaves these areas en route to the personnel decontamination station (PDS), a boot rinse with a detergent solution (from a pre-positioned container) will significantly reduce the spread of contamination along the egress route.

The PDS will be established within the contamination reduction area upwind of the hazardous substance site. The PDS will be located between the hot line (upwind boundary of the exclusion area) and the support (clean) area boundary. Figure 11-1 illustrates the organization of the field operations area.

The PDS provides a controlled decontamination and undressing system designed to avoid the transfer of chemical contamination from protective clothing or equipment to the individual. It must be established before the team enters the contaminated area so that members can immediately and safely cope with an emergency. Team members must be briefed on decontamination procedures prior to entering the contaminated area. When the team leaves the area, extreme care must be taken to insure that proper decontamination is performed. Failure to observe these procedures could result in personal injury.

11.6.1 Organization and Operation of the Personnel Decontamination Station (PDS)

The project team leader must exercise professional judgment in determining how the PDS will be organized and what decontaminants will be used. Factors he must consider include:

- The extent and type of hazard expected;
- Explosive potential;
- Meteorological conditions;

- Topography;
- Levels of protection selected; and
- Availability of equipment and supplies.

This section describes the layout of a PDS for personnel dressed in Levels B and C protection.

Set-up for Levels B and C Decontamination

Figure 11-2 illustrates a PDS designed to support personnel working in Level B or Level C protection. The following is a description of the PDS layout by station.

- Station A - Equipment Drop: A plastic ground sheet on which field equipment is placed by returning members of the work party.

- Station B - Decontamination of Outer Garments: A wash tub filled with the appropriate decontamination solution.

- Station C - Rinse of Outer Garments: A wash tub filled with a water rinse.

- Station D - Boot Removal: A bench or stool for personnel to sit on during removal of the boot covers; and a plastic-lined container for disposal of booties.

- Station E - Glove Decontamination and Rinse: A portable table containing a small bucket of decontamination solution and water rinse.

- Station F - Boot Decontamination and Rinse: A small bench or stool for personnel to sit on during decontamination; a wash tub containing the appropriate decontamination solution; a wash tub containing a water rinse; and a small can for disposal of masking tape.

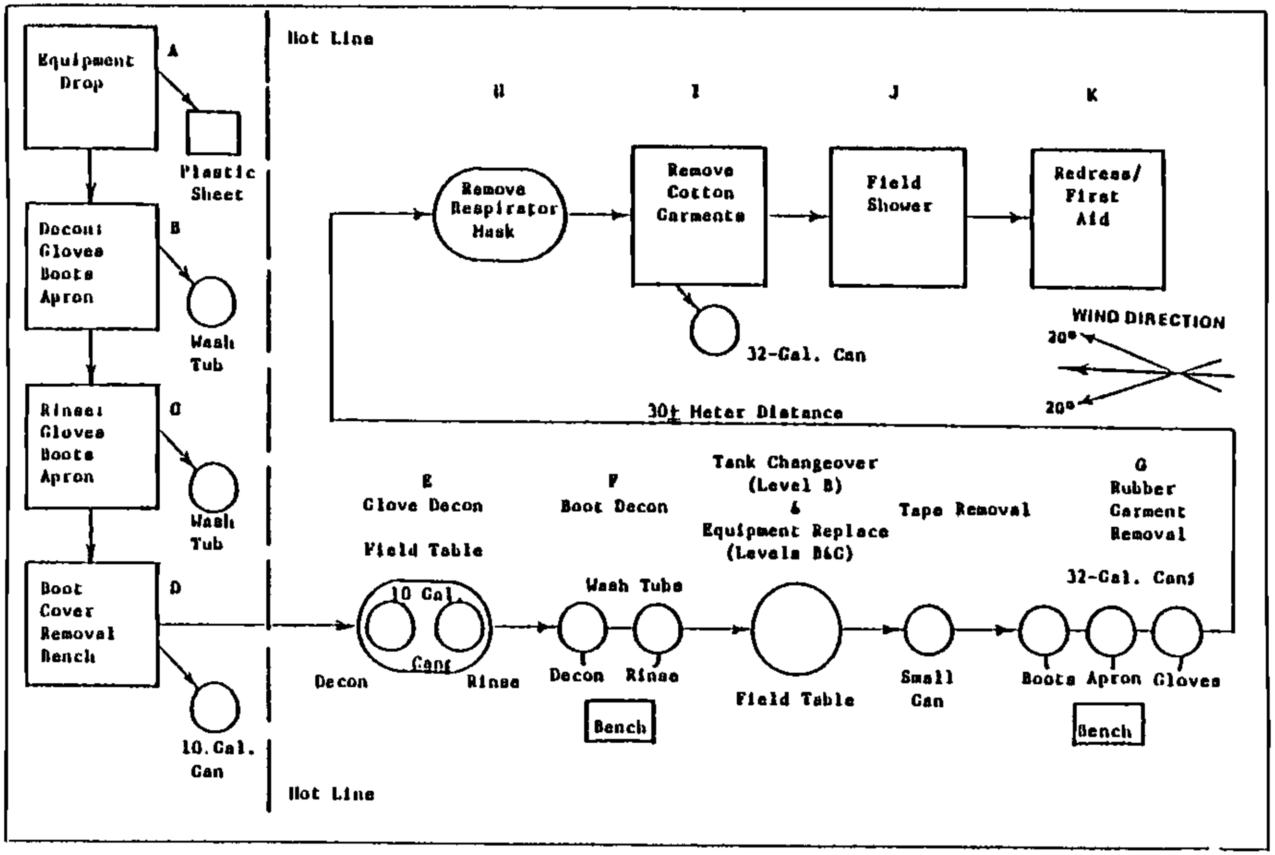

Figure 11–2 TYPICAL LAYOUT OF PDS FOR LEVEL B AND C PROTECTION

- Station G - Boot and Outer Garment Removal: A bench or stool to sit on during removal of boots, aprons, and gloves; and three 32-gallon plastic-lined containers for segregating boots, aprons, and gloves.

- Station H - Removal of Respirator: A portable table approximately 30 meters upwind from Station G on which the self- contained breathing apparatus or air-purifying respirators are placed.

- Station I - Removal of Cotton Garments: A 32-gallon plastic-lined container for disposal of all cotton garments.

- Station J - Field Shower (Optional): A field shower set-up. If impractical or not available, a wash point (container of water, soap, and paper towels) should be provided.

- Station K - Redress and First Aid (Optional): A location to redress and render first aid as necessary. This station separates the contamination reduction area from the support (clean) area.

Levels B and C Decontamination Equipment and Procedures

Station A. Equipment such as instrumentation, sample jars, and sampling devices removed from the hazardous site should be placed on the equipment drop at this station. The plastic sheet used for this purpose is positioned on the downwind side of the hot line just inside the exclusion area. Equipment should be decontaminated by PDS operators only after all work party members have been processed through the PDS. Gross contamination can be removed from equipment either by carefully stripping off protective covers such as plastic bags or through a wash process using an appropriate decontamination solution and water. Protective covers which are removed from the equipment can be placed in the same container as the disposable booties at Station D. Equipment should be thoroughly decontaminated before taking it across the hot line.

Station B. This station is the initial and most critical step in the personnel decontamination process. The individual being decontaminated should be directed to stand in the wash tub while the PDS operator, using long-handled brushes, carefully decontaminates all outer rubber garments. Care should be exercised when decontaminating personnel wearing Level B and Level C protection to avoid splashing with decontamination solution.

Station C. This station is a rinse station. Again, the individual being decontaminated should be directed to stand in the wash tub. Care again must be exercised in rinsing the rubber garments.

Station D. Prior to crossing the hot line, the work party member should remove disposable booties and place them in the receptacle located at this station.

Station E. At this station, work party members will decontaminate and rinse their gloves. A field table is recommended to elevate the decontamination and rinse solution to waist height.

Station F. Work party members will sit on the bench provided while PDS operators will sequentially decontaminate and rinse the boots. The small container located between Stations F and G is used to dispose of all used masking tape.

Station G. Work party members will sit on the bench provided and sequentially remove their boots, apron, and gloves.

Station I. The individual will remove all cloth undergarments such as coveralls, socks, and underwear, and place them in the container provided.

Station J. This station is a field shower facility. If a shower is not available, personnel should as a minimum wash their hands and faces before leaving the site. Personnel should be instructed that a shower is required to complete the decontamination process.

Station K. After showering, work party members will redress into clean clothes and receive first aid (e.g., treatment of minor cuts and bruises), if required. The individual then leaves the PDS and moves into the support area.

11.6.2 Preparation of Decontamination Solutions

Ideally, the decontamination solution used should react with and chemically neutralize the contaminants found at a hazardous substance site. However, since the contaminants on a particular site will be unknown in most cases, a decontaminant is more often chosen based on its ability to physically remove (dissolve or suspend) the contaminant in question.

In all decontamination operations water is a recommended solvent. Organic solvents dry the skin and are often more toxic than the hazard one is trying to eliminate. These solvents also accelerate the deterioration and penetration of protective clothing. Water, on the other hand, does not damage protective clothing and does not contribute to secondary contamination.

It must be recognized that there are no universal decontaminants and the project team leader will often be required to make a professional judgment regarding this matter. Table 11-1 lists chemical mixtures suggested as readily available general-purpose decontaminants. Their application and instructions for preparation are also presented in the table.

11.6.3 Closure of the PDS

When the PDS is no longer needed, it should be closed down by the PDS operators. All disposable clothing and plastic sheeting used during the operation should be double-bagged and either contained on-site or removed to an approved off-site disposal facility. Decon and rinse solution could be discarded on-site or also removed to an approved disposal facility. Reusable rubber clothing should be dried and prepared for future use. (If gross contamination has occurred, additional decontamination of these items may be required.) Cloth items should be bagged and removed from the site for final cleaning. All wash tubs, pails, containers, etc., should be thoroughly washed, rinsed, and dried prior to removal from the site.

12. SAMPLE HANDLING AND PACKING

12.1 SPLIT SAMPLE PROCEDURES

When split samples are requested, identical sample tags will be attached by E & E personnel to the two (or more) containers. The E & E sample will be clearly marked as such and treated in accordance with normal procedures. Any other split samples will remain subject to chain-of-custody procedures until they are relinquished to the person requesting them. E & E personnel also may be required to comply with the custodial procedures preferred by the person requesting the split samples; these procedures will be complied with on a case-by-case basis. All split samples will be documented in the site logbook.

12.2 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

In order to preserve sample integrity either for physical, chemical, or biological analyses as well as to have a sufficient volume of each sample for analysis, all samples will be collected in the appropriate containers, preserved when required, and stored at the appropriate temperature. Various sample containers (e.g., glass, plastic) and container sizes will be used, depending on the specific analyses required. Table 12-1 lists the sample containers, preservatives, and holding times to be used to analyze for the priority pollutants listed in 40 Code of Federal Regulations (CFR) Part 136. Table 12-2 lists the sample bottles to be used, the volumes, the preservatives, and the holding times for biological parameters, physical parameters, metals, inorganic and nonmetallic compounds, and organic compounds. All of the listed sample containers, preservatives, and holding times in the tables are approved and/or recommended by EPA.

Table 12-1

RECOMMENDED SAMPLE STORAGE, PRESERVATION, AND HOLDING TIMES OF PRIORITY POLLUTANTS: EPA 40 CFR 136

Parameter	Container*	Preservative	Holding Time
Purgeable halocarbons	A	4°C	7 days
Purgeable aromatics	A	4°C	7 days
Acrolein acrylonitrile	A	4°C	7 days
Phenols	B	4°C	**
Benzidines	B	4°C	**
Phthalate esters	B	4°C	**
Nitrosamines	B	4°C	**
Organochlorine pesticides and polychlorinated biphenlys (PCBs)	B	4°C	**
Nitroaromatics and isophorone	B	4°C	**
Polynuclear aromatic hydrocarbons	B	4°C	**
Haloethers	B	4°C	**
Chlorinated halocarbons	B	4°C	**
2,3,7,8-tetrachloro-dibenzo-p-dioxin	B	4°C	**
Purgeables	A	4°C	7 days
Base/neutrals, acids, and pesticides	B	4°C	**
EPA 40 CFR 141: Trihalomethanes (THM) (Drinking Water)			
Tap water***	A	4°C	14 days
Open body	A	4°C	14 days

Key:

A = 40-mL clear screw-cap septum vials plus caps with 22-mm Tuf-Bond Teflon silicone discs.
B = 1/2-gallon amber glass bottle with Teflon-lined cap.

*The bottles, vials, caps, and discs listed here are those listed in EPA 40 CFR 136 (Federal Register, December 3, 1979, revised October 26, 1984) and EPA 40 CFR 141 (Federal Register, November 29, 1979).
**Extracted within seven days and analyzed within 30 days.
***If the tap water is chlorinated, 2.5 to 3.0 mg of sodium sulfite ($NA_2S_2O_3$) per 40 mL of water sample is used unless maximum trihalomethane concentration is to be determined.

Table 12-2

RECOMMENDED SAMPLE STORAGE, PRESERVATION, AND HOLDING TIMES ACCORDING TO MEASUREMENT[1]

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Biological Parameters				
Fecal coliform	100	Autoclaved P,G	Cool, 4°C	6 hours
Total coliform	100	P,G	Cool, 4°C	6 hours
Fecal streptococci	100	P,G	Cool, 4°C	6 hours
Standard plate count	100	P,G	Cool, 4°C	6 hours
Benthos (macrobenthic invertebrates)	--	P,G	Formalin/ Glycerine	6 months
Chlorophyll-a	1,000	P,G	Filter on-site Freeze immediately	3 months
Phytoplankton	250	P,G	2 mL Lugol's Solution	6 months (darkness)
Zooplankton	250	P,G	Formalin/ Glycerine	4 months
Physical Parameters				
Color	50	P,G	Cool, 4°C	24 hours
Conductance	100	P,G	Cool, 4°C	24 hours[4]
Hardness	100	P,G	Cool, 4°C HNO_3 to pH <2	6 months[5]
Odor	200	G only	Cool, 4°C	24 hours
pH	25	P,G	In situ	6 hours
Residue				
Filterable	100	P,G	Cool, 4°C	7 days
Nonfilterable	100	P,G	Cool, 4°C	7 days
Total	100	P,G	Cool, 4°C	7 days
Volatile	100	P,G	Cool, 4°C	7 days
Settleable matter	1,000	P,G	None required	2 days
Temperature	1,000	P,G	In situ	No holding
Turbidity	100	P,G	Cool, 4°C	48 hours

Table 12-2 (Cont.)

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Metals				
Dissolved	200	P,G	Filter on-site HNO_3 to pH <2	6 months[5]
Suspended	200		Filter on-site	6 months
Total	100	P,G	HNO_3 to pH <2	6 months[5]
Mercury				
Dissolved	100	P,G	Filter on-site HNO_3 to pH <2	38 days (glass) 28 days (hard plastic)
Total	100	P,G	HNO_3 to pH <2	38 days (glass) 28 days (hard plastic)
Inorganics, Nonmetallics				
Acidity	100	P,G	None required	24 hours
Alkalinity	100	P,G	Cool, 4°C	24 hours
Bromide	100	P,G	Cool, 4°C	24 hours
Chloride	50	P,G	None required	7 days
Chlorine	200	P,G	Determined on site	No holding
Cyanides	500	P,G	Cool, 4°C NaOH (sodium hydroxide) to pH 12 and Ascorbic Acid-Treat with Cd if Sulfide is present	24 hours
Dissolved oxygen				
Probe	300	G only	*In situ*	No holding
Winkler	300	G only	Fix on-site	4-8 hours
Fluoride	300	P,G	None required	7 days
Iodide	100	P,G	Cool, 4°C	24 hours
Nitrogen				
Ammonia	400	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours
Kjeldahl, total	500	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]

Table 12-2 (Cont.)

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Inorganics, Nonmetallics (Cont.)				
Nitrate plus nitrite	100	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Nitrate	100	P,G	Cool, 4°C	24 hours
Nitrite	50	P,G	Cool, 4°C	48 hours
Phosphorus, ortho-phosphate, dissolved	50	P,G	Filter on-site Cool, 4°C	24 hours
Hydrolyzable	50	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Total	50	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Total dissolved	50	P,G	Filter on-site Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Silica	50	P only	Cool, 4°C	7 days
Sulfate	50	P,G	Cool, 4°C	7 days
Sulfide	500	P,G	2 mL zinc acetate & NaOH	7 days
Sulfite	50	P,G	Determined on-site	No holding
Organics				
BOD	1,000	P,G	Cool, 4°C	24 hours
COD	50	P,G	H_2SO_4 to pH <2	7 days[6]
Methylene blue active substance (MBAS)	250	P,G	Cool, 4°C	24 hours
Nitrilotriacetic acid (NTA)	50	P,G	Cool, 4°C	24 hours
Oil and grease	1,000	G only	Cool, 4°C H_2SO_4 or HCl to pH <2	24 hours
Organic carbon	25	P,G	Cool, 4°C H_2SO_4 or HCl to pH <2	24 hours
Phenolics	500	G only	Cool, 4°C H_2SO_4 to pH <4 1.0 g $CuSO_4$/1	24 hours

Key:

1. More specific instructions for preservation and sampling are found with each procedure as detailed in E & E's methods manual. A general discussion on sampling of water and industrial wastewater may be found in American Society for Testing and Materials (ASTM), Part 31, p. 72-82 (1976) Method D-3370.

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

3. The listed holding times are recommended for properly preserved samples based on currently available data. It is recognized that extension of these times may be possible for some sample types while, for other types, the times may be too long. When shipping regulationa prevent the use of the proper preservation technique or when the holding time is exceeded, as in the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance. If samples cannot be analyzed within the specified time intervals, the final reported data should indicate the actual holding time.

4. If the sample is stabilized by cooling, it should be warmed to 25°C for reading, or a temperature correction should be made and results reported at 25°C.

5. When HNO_3 cannot be used because of shipping restrictions, the sample may initially be preserved by icing and immediately shipped to the laboratory. Upon receipt at the laboratory, the sample must be acidified to a pH <2 with HNO_3 (normally 3 mL 1:1 HNO_3/liter is sufficient). At the time of analysis, the sample container should be thoroughly rinsed with 1:1 HNO_3 and the washings added to the sample (volume correction may be required).

6. Data obtained from National Enforcement Investigations Center, Denver, Colorado, support a four-week holding time for this parameter in sewerage systems (Standard Industrial Code 4952).

12.3 SAMPLE HANDLING AND DECONTAMINATION

E & E will identify all samples using a sample tag or other appropriate identification attached to or folded around the sample. The tag will provide the sample identification number; the date, time, and location of collection; designation of the sample as a grab or composite; notation of the type of sample and preservative; any remarks; and the signature of the sampler. E & E also will record this information in the appropriate logbook, along with any pertinent on-site measurement data and field observations.

After collection and identification, the sample will be preserved and maintained under the chain-of-custody procedures discussed below. In a similar fashion, all tags on blank or duplicate samples will be marked "Blank" or "Duplicate," respectively. Field blind duplicates will be coded and identified as such only in the field logbook.

Chain-of-Custody Procedures

Air Force chain-of-custody requirements for this program will be clarified and incorporated in E & E's standard operating procedures. E & E will require that the possession of samples be traceable from the time the samples are collected until they are disposed of through established chain-of-custody procedures. The major elements of these E & E procedures include the following.

Sample Custody. A sample will be considered in custody if:

- It is in the individual's actual possession; or
- It is in the individual's view, after being in his/her physical possession; or
- It was in the individual's physical possession and then he/she locked it up to prevent tampering; or
- It is in a designated secure area.

Field Custody Procedures. E & E will collect only the number needed to provide a fair representation of the media being sampled. The quantity and types of samples and sample locations will be determined prior to the actual fieldwork. As few people as possible will handle the samples. The field sampler will be personally responsible for the care and custody of the collected samples until they are transferred or properly dispatched. Sample tags will be completed for each sample using waterproof ink.

Transfer of Custody and Shipment. Samples will be accompanied by a chain-of-custody record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document the transfer of custody of the samples from the sampler to another person, or to an analytical laboratory.

The samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate record prepared for each laboratory. The "Courier to Airport" space on the chain-of-custody record will be dated and signed, if necessary.

All packages will be accompanied by the chain-of-custody record showing identification of the contents. The original record will accompany the shipment and a copy will be retained by E & E.

Laboratory Custody Procedures. E & E will assure that the possession of samples is traceable from the time the samples are received. To maintain and document sample possession, E & E will follow chain-of-custody procedures. A sample custodian or a designated alternate will receive samples for the laboratory and will verify that the information on the sample tags matches that on the chain-of-custody record included with the shipment. The custodian will sign the custody record in the appropriate space. Couriers picking up samples at the airport, post office, etc., will sign in the appropriate space.

Samples forwarded to the laboratories for analysis will be retained after the analyses are completed. These samples may be disposed of only upon the orders of the program manager, and only after all tags have been removed for the permanent file.

Sample Decontamination

All sampler containers will be considered as contaminated and subject to standard decontamination procedures prior to packaging in preparation for storage and/or shipment to laboratories for analysis. Decontamination procedures will include washing the container in a cleaning solution containing Alconox on TSP, followed by a thorough rinse with clean water. The samples will be immediately placed into a protective plastic wrap to prevent further possible contamination.

12.4 PROCEDURES FOR PACKING LOW CONCENTRATION SAMPLES

All samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements must be followed:

- Sample bottle lids are never to be mixed. All sample lids must stay with the original containers. Custody seals must be affixed.

- The sample volume level can be marked by placing the top of the label at the appropriate sample height, or with grease pencil. This procedure will help the laboratory to determine if any leakage occurred during shipment. The label should not cover any bottle preparation OA/QC marks.

- Unless otherwise specified, all sample bottles must be secured with a custody seal and placed in a plastic bag to minimize the potential for vermiculite contamination.

- Shipping coolers must be filled initially with approximately three inches of vermiculite or zonolite.

- The secured sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.

- Low hazard samples (i.e., defined as environmental or less than 10 ppm of any single constituent) are to be cooled.

"Blue ice" or some other artificial icing material is preferred. If unavoidable, ice may be used provided that it is placed in 3-mil plastic bags. Ice is not to be used as a substitute for packing material.

- Any remaining space in the cooler should be filled in with inert packing material. Under no circumstances will locally obtained material (sawdust, sand, etc.) be used.

- The duplicate custody record must be placed in a plastic bag and taped to the bottom of the cooler lid.

12.5 PROCEDURES FOR PACKING MEDIUM CONCENTRATION SAMPLES

The procedures for packing medium concentration samples (defined as containing between 10 and 150,000 ppm of any constituent, or direct but diluted contamination, or material from previous spills, or discolored solid matrices or turbid liquids) are similar to those discussed in Section 12.4 with two notable exceptions. All medium hazard samples must first be placed in paint cans containing sufficient vermiculite or zonolite inert materials to cushion the sample containers and absorb spills. These paint cans are sealed, properly labelled, and then placed in the cooler or other appropriate shipping container, as described in Section 13.6. Medium hazard samples are not to be cooled with ice or some other artificial icing materials.

13. SAMPLE CUSTODY AND DOCUMENTATION

13.1 SAMPLE IDENTIFICATION DOCUMENTS

All field personnel must verify the sampling methods to be used during sample collection by making proper reference to the project plans. Prior to sampling, the field sampling personnel must ensure that all sample containers are in his physical possession or in his view at all times, or ensure that the containers are stored in a locked place at all times, so as to maintain proper custody. All sample gathering activities must be recorded in the site logbook; all sample transfers must be documented in the chain-of-custody record; all samples are to be identified with sample tags, labels, or other appropriate means of identification (hereinafter referred to as sample tags); and all sample bottles are to be sealed with custody seals. All information is to be recorded in waterproof ink. All E & E field personnel are personally responsible for sample collection and the care and custody of collected samples until the samples are transferred or properly dispatched.

13.2 CHAIN-OF-CUSTODY RECORDS

The custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who has been designated by the project manager as being responsible for sample shipment to the appropriate laboratory for analysis. The information specified on the chain-of-custody record will contain the same level of detail found in the site logbook, with the exception that the on-site measurement data need not be recorded. The custody record will include, among other things, the following information: name of person collecting the samples; date samples were collected; type of sampling conducted (composite/grab); location of sampling station; number and type of containers used; and signature of the E & E person relinquishing samples to a non-E & E person, such as a Federal Express agent, with the date and time of transfer noted. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the remarks section of the custody record.

If it is is not practicable to seal all containers at a Federal Express office, they should be sealed beforehand. The duplicate custody record will therefore have the signature of the relinquishing field technician and a statement of intent such as "To Federal Express (Baltimore office) p.m. 6/31/84." The duplicate custody record is then placed in a plastic bag, taped to the underside of the box lid, and the box closed. The container is to be tightly bound with filament tape, and if required, at the discretion of the project manager, may be padlocked. Finally, at least two custody seals are to be signed by the individual relinquishing custody and affixed in such a way that the box cannot be opened without breaking them.

At the shipping agent's office, the relinquishing individual will put all the specific shipping data (airway bill number, office, time, and date) on the original custody record which is to be transmitted to the project manager (by mail or by hand as appropriate). The original and duplicate custody records and the airway bill or delivery note together constitute a complete record and it is the project manager's responsibility to ensure that all are consistent and they are made part of the permanent job file maintained at the ASC.

At the laboratory, the sample custodian will open the package, retrieve the duplicate record, and complete the "Received for Laboratory by" box by affixing his signature. The custodian also is to fill in the "Method of Shipment" box with the shipper's name (e.g., Federal Express) and airway bill number.

13.3 FIELD LOG BOOKS

Site logbook(s) must be maintained for each project. All site logbooks must be bound, contain numbered pages, and be waterproof. The following documentation is to be recorded in the site logbooks: sampling locations, station numbers, dates, times, sampler's name, designation of the sample as a grab or composite, notation of the type of sample (e.g., groundwater, soil boring, etc.), preservatives used, on-site measurement data, and other field observations and remarks. Each series of site logbook entries for a particular sampling effort must be initialed by the person recording the information and, where appropriate, summary entries that organize and/or clarify data presented in the logbook are to be prepared by the person recording the information. After reviewing the entries, the field team leader must sign each page of the site logbook on the top and the bottom.

As with all data logbooks, no pages will be removed for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (in such a manner that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

The site logbook is the prime repository of information of actual site conditions and as such is an important link in the analytical chain. Any details which may be relevant to the analysis or integrity of samples must be recorded. Preliminary sample descriptions are helpful. Any unusual circumstances should be noted, e.g., heavy rain or difficulty in pH meter calibration. At the completion of the sampling exercise, the logbook must be retained by and/or returned to the project manager and is to be made part of the permanent project file. To the extent that any information contained in the logbook is relevant to sample analysis to be performed, such data are to be made available to the laboratory performing said analyses by the project manager.

13.4 CORRECTIONS TO DOCUMENTATION

As with data logbooks, if corrections to any site documentation are necessary, these must be made by drawing a single line through the original entry (in such a manner that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

When completing any of the laboratory logs, all crossouts and/or changes in logbook entries must be made with a single line and initialed by the same custodian who is responsible for the original entry; corrections also may be supplemented by a footnoted explanation, so long as the footnote is initialed by the same custodian responsible for the original entry. This general rule may be relaxed only if the ASC director or manager authorizes such a deviation from the rule and initials the change together with the other custodian making the correction.

13.5 TRAFFIC REPORTS, SAMPLE LABELS, AND CUSTODY SEALS

Traffic Reports

The documentation system provides the means to individually identify, track, and monitor each sample from the point of collection through final data reporting based on the use of sample traffic reports, each printed with a unique sample identification number. One traffic report and identification number is assigned by the sampler to each sample taken. Then, regardless of where a sample was collected or analyzed, the sample can always be identified and tracked by use of the assigned number. Traffic reports are used in conjunction with chain-of-custody and other document requirements.

To provide a permanent record for each sample collected, the sampler completes the traffic report in triplicate at the time the sample is taken. Data required include the project identification number, site location and number, dates and times when samples were taken, shipping information, name of laboratory preforming analysis, and estimated and sample concentration. The top copy becomes the sampler's file copy. The bottom two copies are sent with the samples to the designated laboratory. Upon receipt of the samples, the laboratory completes the required information concerning sample conditions and documentation. The laboratory then returns one copy to the project manager and retains a copy for their files.

Sample Tags

E & E field personnel will properly identify all samples taken in the field by using a sample tag attached to or affixed around the sample container. The sample tag must contain the field identification number; the date, time, and location of sample collection; designation of the sample as a grab or composite; notation of the type of sample (e.g., groundwater, soil boring, etc.); identification of preservatives used; any remarks; and the signature of the sampler. The sample tags are to be placed on the bottles so as not to obscure any QA/QC data on the bottles. Sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-reference with the site logbook.

Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if they are disturbed. Individual sample bottles are sealed over the cap by the sampling technician. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals are signed and dated before use. On receipt at the laboratory, the custodian will check (and certify, by completing logbook entries) that seals on boxes and bottles are intact.

13.6 SHIPPING OF SAMPLES

Environmental and hazardous samples will be properly packaged and labelled for shipment and dispatched to the appropriate laboratory for analysis. A separate chain-of-custody record must be prepared for each laboratory. The following requirements for shipping containers must be followed:

- United States Department of Transportation (DOT) regulations covering the transport of hazardous materials are contained in 49 CFR Parts 170-179.

- Shipping containers must be padlocked or custody-sealed for shipment, as appropriate. The package custody seal is to consist of filament tape wrapped around the package at least twice and a custody seal affixed at appropriate access points. In this way, access to the package can be gained only by cutting the filament tape and breaking the seal.

- All of the shipping coolers/package containers must be secured by field personnel with a proper custody seal, marked with indelible pen or ink, and addressed to Ecology and Environment, Inc., Analytical Services Center, 4285 Genesee Street, Buffalo, NY 14225, or another laboratory as appropriate.

- Field personnel must make arrangements for transportation of samples to the ASC. When custody is relinquished to a shipper, E & E field personnel must telephone the ASC custodian (716/631-0360) to inform him of the expected time of arrival of the sample shipment and to advise him of any existing time constraints on sample analysis.

14. SITE CLEAN-UP

The objective of site clean-up is to leave the areas of investigation essentially as they were found, except of course for the physical addition of monitoring wells and guard posts. Site clean-up also includes close coordination with base personnel to insure that clean-up operations are in accordance with overall management of base operations.

E & E has responsibility for assuring the safe and proper conduct of subcontractors in this work and the associated equipment. Decontamination procedures will be conducted to insure that potential contamination remains on-site. General cleanup of equipment and vehicles will be conducted consistent with accepted facility practices and in close coordination with the Base Engineer (BE).

Drill cuttings and investigation-derived wastes (e.g., expendables such as Tyvek over-suits) become the property of the facility. These materials will be labeled and staged in the secure area (with assistance from the BE) pending the results of analyses that will determine whether these wastes can be generally disposed or must be disposed as contaminated or hazardous waste.

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15. FIELD TEAM ORGANIZATION AND RESPONSIBILITIES

Once the strategy and objectives of the work plan have been developed, a team must be organized to implement the plan. The specific techniques described in the work plan are likely to include: environmental sampling, sampling of hazardous substances, drilling operations, mapping, hazardous substance inventory, etc.

Hazardous substance sites present many hazards, physical conditions, and situations that require a wide variety of expertise and scientific support to insure safe entry and data collection. It is impractical to design a standard site entry team given the significant differences among sites. Therefore, each site requires a team tailored to the potential hazards and objectives of each specific site. The field investigation team will likely consist of individuals with various technical backgrounds, i.e., chemist, engineer, hydrogeologist, who will also fill field positions such as site safety officer or command post supervisor.

A team entering a hazardous substance site is organized for mutual support and safety. Hazardous site investigations require a complete respect for safety by all team members to prevent injury or loss of life.

15.1 ORGANIZATION AND RESPONSIBILITIES

There are eight roles which may be required for a field investigation team. These roles are dictated by the potential site hazards. Dual role assignments are not encouraged but may be acceptable when hazardous substances and physical conditions at a site are well documented.

The following addresses the duties and responsibilities of the eight roles:

- Project team leader;
- Field team leader;
- Site safety officer;
- Personnel decontamination station (PDS) operator/equipment specialist;
- Command post supervisor;
- Initial entry party;
- Work party; and
- Emergency response team.

Project Team Leader

The project team leader is primarily an administrator when not participating in the field investigation as field team leader or command post supervisor. The project team leader is responsible for:

- All the team does or fails to do. Some of this responsibility may be passed on to the field team leader and site safety officer;
- Preparation and organization of all project work;
- Selection of team personnel and briefing them on specific assignments;
- Obtaining permission to enter the site from the owner;

- Coordinating with the field team leader to complete the work plan;

- Completing final reports and preparation of the evidentiary file; and

- Insuring that safety and equipment requirements are complete.

Field Team Leader

The field team leader is responsible for the overall operation and safety of the field team. As mentioned, this role can be filled by the project team leader or his designated representative. The field team leader may join the work party. He is responsible for:

- Safety and safety procedure enforcement;

- Field operations management;

- Public relations/state and federal liaison;

- Site control;

- Compliance of field documentation and sampling methods with evidence collection procedures;

- Execution of the site work plan; and

- Determination of the level of personal protection required (in conjunction with the site safety officer).

Site Safety Officer

The site safety officer has primary responsibility for all safety procedures and operations on-site. Ideally, the site safety officer will report to the person responsible for safety in the organization rather than to the field team leader or project team leader. This allows two separate lines of authority. It also allows decisions based on safety to be represented on an equal basis with decisions based on the pressures for accomplishing the investigation according to schedule.

The site safety officer remains half-dressed in the appropriate level of protective equipment to respond to emergencies. He stays on the clean side of the exclusion area while monitoring the work party and site activities. The site safety officer is also responsible for:

- Updating equipment or procedures based on new information gathered during the site inspection;

- Upgrading the levels of protection based on site observations;

- Enforcing the "buddy system";

- Determining and posting locations and routes to medical facilities, including poison control centers; arranging for emergency transportation to medical facilities;

- Notifying local public emergency officers, i.e., police and fire department, of the nature of the team's operations, and posting their telephone numbers;

- Controlling entry (if possible) of unauthorized persons to the site;

- Entering the exclusion area in emergencies when at least one other member of the field team is available to stay behind and notify emergency services, or after he has notified emergency services;

- Examining work party members for symptoms of exposure or stress;

- Determining the suitability of a team member for work in the exclusion area, based on the team member's physical profile determined by the health and safety program and the team member's current physical condition; and

- Providing emergency medical care and first aid as necessary on-site. The site safety officer has the ultimate responsibility to stop any operation that threatens the health or safety of the team or surrounding populace.

PDS Operator/Equipment Specialist

The PDS operator/equipment specialist functions in two roles that do not require concurrent attention. As the equipment specialist, he is charged with:

- Insuring that all equipment is poperly maintained and operating;
- Inspecting all equipment before and after use;
- Insuring that all required equipment is available; and
- Decontaminating all personnel, samples, and equipment returning from the exclusion area.

The PDS operator/equipment specialist is responsible for design and setup of the PDS and for preparing the necessary decontamination solutions to insure that chemical contamination is not transported into the clean area by inspection equipment, samples, protective clothing, or personnel. Failure to properly execute these duties reduces the effectiveness of the protective equipment and threatens the rest of the field team. The PDS operator/equipment specialist also manages the mechanics of removing contaminated clothing from the work party and the proper disposal of discarded contaminated clothing and decontamination solutions.

Command Post Supervisor

The command post supervisor functions as the clearinghouse for communications. He does not enter the exclusion area to assist the work party except for certain emergency situations. Should an emergency arise, the command post supervisor notifies emergency support personnel by phone, radio, etc., to respond to the situation.

Depending on the team size and the nature of the emergency, the command post supervisor may in extreme situations assist the site safety officer in effecting a rescue. Usually, the command post supervisor may be called upon to assist the PDS operator/equipment specialist in operating the PDS during an emergency, and assist the site safety officer in emergency medical measures. The field team leader may assume the position of command post supervisor.

The command post supervisor is also responsible for:

- Maintaining a log of communications and site activities such as duration of work periods with respirators;
- Sustaining communication and line-of-sight contact with the work party;
- Maintaining public relations in the absence of the field team leader; and
- Assisting the site safety officer and PDS operator/equipment specialist as required.

Initial Entry Party

The initial entry party enters the site first, employing specialized instrumentation to characterize site hazards. Usually the field team leader should be a part of the initial entry party to familiarize himself with conditions and dangers associated with the site. The major purpose of this team is to measure existing hazards and survey the site to ascertain if the level of personal protection determined from preliminary assessment and site inspection must be adjusted.

The initial entry party can consist of as few as two people if a wheelbarrow or other device is used to transport all the instrumentation. Three or four people are able to do the job more efficiently.

Work Party

The work party performs the on-site tasks necessary to fulfill the objectives of the investigation, e.g., obtaining samples or determining locations for monitoring wells. No team member should enter or exit the exclusion area alone. The work party consists of a minimum of two individuals, and any work party should follow this buddy system. Besides the safety considerations, it is much easier for two persons dressed in protective clothing to perform such tasks as note-taking, photographing, and sampling.

Emergency Response Team

Extensive assignments requiring long hours and large work parties (more than five) necessitate the use of a standby emergency response team. The emergency response team is half-dressed in protective gear so that it can quickly enter the exclusion area in the event of an emergency. This team is particularly valuable at dangerous sites where protective equipment produces stress and heat loads on the work party.

15.2 TEAM SIZE

The size of a team employed in an investigation is determined by two sometimes contradictory requirements: the need for a team large enough to maximize safety versus the desire for economy. Team size is dependent upon site organization, levels of protection, work objectives, and site hazards. Additional team members can always be added according to the roles required.

Two-Person Team

The two-person team is the minimum for a hazardous substance site investigation, but is very limited. Such a team should never enter an inactive hazardous substance site. The two-person team is best suited for off-site surveys and inspections or obtaining environmental (non-hazardous, off-site) samples. Ground truthing of aerial photographic surveys, inspection of files, or interviews can all be accomplished by the two-person team.

Three-Person Team

The three-person team can be employed on sites requiring Level C protection and, in some cases, on sites requiring Level B protection. This team is composed of field team leader; an individual fulfilling the combined functions of PDS operator/equipment specialist, site safety officer, and command post supervisor; and another individual to enter the site with the field team leader.

The three-person team is used where extensive PDS procedures are not required and where the likelihood of emergency rescue is low. This field investigation team is best utilized in non-IDLH (immediately dangerous to life and health) atmospheres where the primary objective is to map, photograph, or inventory. Its use assumes that at no time will the work party be exposed to hazardous situations.

Considerable care and thought are necessary before a three-person team is employed on a site because each individual has numerous responsibilities. In the event of an accident, the third member does not enter the site to offer emergency assistance until he has summoned outside assistance, and even then, only when he feels rescue will not endanger his own life.

Four-Person Team

Most Level B operations can be conducted with a four-person team. These operations would include work on active sites where facility personnel are present or on inactive sites with potentially IDLH atmospheres. The objectives of a four-person team at a site requiring Level B protection might include sampling of ponds, soils, or open containers and inspections at sites known for poor housekeeping, i.e., spills, leaks, etc.

The team consists of the standard two-person work party, a combination site safety officer and PDS operator/equipment specialist, and a command post supervisor who may assist in the PDS operation. Because life-threatening hazards are assumed or known to be present at a Level B site, it is essential that all personnel be fully acquainted with their duties. During an emergency, the command post supervisor stays in the support area to maintain communication while the site safety officer/PDS operator/equipment specialist enters the exclusion area to aid the work party. Once the work party is in the contamination reduction area, the command post supervisor can then offer assistance on the PDS or provide fresh equipment from the support area.

Five-Person Team

The five-person team is the minimum size for most Level B operations or when known percutaneous hazards exist or there is an absence of historical information. The site hazards that require Level B protection, combined with the limitations and stresses placed on personnel by wearing Level B protection, generally necessitate a full-time PDS operator/equipment specialist who can also serve in emergency response. In the event of a serious emergency such as a fire, explosion, or acutely toxic release, both the site safety officer and PDS operator/equipment specialist may need to enter the exclusion area dressed in Level B gear. The command post supervisor remains in the support area to direct outside help to the site and then assume the functions of PDS operator/equipment specialist.

Teams of Seven or More

Certain hazardous substance sites requiring sampling operations necessitate larger or alternating work parties and additional support personnel in the contamination reduction area. The seven-person team employs the basic five-person structure plus an additional work party for alternating work loads. The eight-person team includes an additional PDS operator/equipment specialist to assist in the continuous decontamination tasks involved with alternating work parties, and to decontaminate and pack samples as they are received.

It is not unusual to employ larger teams where such tasks as drum opening may, require three work parties downrange working concurrently or may require a team to work under rigorous safety procedures. Larger teams can be designed with additional work parties and support personnel to safely gather the site data and insure communication and site control.

15.3 TRAINING

Although trained and experienced personnel are assigned, training is essential to successful project completion.

Mobilization Meeting

Before mobilization begins, a team training meeting is held to discuss assignments and the needs of the work, including equipment and health and safety requirements.

On-Site Start-Up Meeting

During site start-up, a team training meeting and site tour are conducted to review the health and safety plan, particular protocols for the project, and the project objectives. In keeping with E & E corporate health and safety policies, every site worker must complete this orientation regardless of when they begin initial site work on the project. Records are maintained of this meeting and the topics covered.

Daily Briefings and De-Briefings

Each morning a short briefing is held for all team members to outline the objectives for the day and allow health and safety monitoring. Instrument calibration checks usually occur during this time also. On sites with high potential for chemical exposure, a site survey tour would be made with monitoring instruments before fieldwork is allowed to begin. Based on current knowledge, this daily survey team is not needed for the work at Richards-Gebaur AFB.

At the end of each work day, a short de-briefing meeting is held to review accomplishment vs. objectives and to identify objectives for the next day's work. Data evaluation, planning, and sample management and shipping often follow this meeting.

16. SCHEDULE

A project milestone chart is presented in Table 16-1 to illustrate the sequence of tasks as approximated at the beginning of the project. Field conditions may impose minor variations in the schedule.

Table 16-1

FIELDWORK MILESTONE CHART

Time (weeks from start)	Site	Activity
0-2	All	Project start-up tasks: prepare work plan and site safety plan; secure drilling subcontract equipment and supplies.
2-3	1,2,3,4	Perform geophysical surveys; soil gas analysis; sediment and water sampling.
3-5	1,2,5,6	Perform soil boring and install monitoring wells.
4-5	3,6,7	Perform soil boring and install monitoring wells; demobilize
5-18	All	Prepare draft final report (due 18 March 1987).

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APPENDIX A

SITE SAFETY PLAN

ecology and environment, inc.

HAZARDOUS AND TOXIC MATERIALS TEAM
SITE SAFETY PLAN

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A. GENERAL INFORMATION

SITE: Richards-Gebaur Job No.: DF-4000

LOCATION: Belton, MO near Kansas City

PLAN PREPARED BY: Paul Kopsick DATE: ____

APPROVED BY: William [signature] DATE: 9-12-86

OBJECTIVE(S): Phase II Stage 2 Field Investigation
Soil, sediment surface water and groundwater sampling.

PROPOSED DATE OF INVESTIGATION: September 1986 - December 1986

BACKGROUND REVIEW: Complete: X Preliminary: ____

DOCUMENTATION/SUMMARY: Overall Hazard: Serious: ____ Moderate: ____ Low: X Unknown: ____

B. SITE/WASTE CHARACTERISTICS

WASTE TYPE(S): Liquid X Solid X Sludge ____ Gas ____
Corrosive ____ Ignitable ____ Radioactive ____ Volatile ____
Toxic ____ Reactive ____ Unknown ____ Other (Name) ____

FACILITY DESCRIPTION: Air Force Base with areas of Aircraft and Vehicle maintenance and onsite landfill of municipal refuse. Storage of pesticedes and solvents associated with normal operations.

Principal Disposal Method (type and location): Landfills drum storage areas

Unusual Features (dike integrity, power lines, terrain, etc.): NONE

Status: (active, inactive, unknown) In-active - active

History: (injuries: complaints: previous agency action): No significant history of environmental problems. Phase I report contains history of individual site.

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C. HAZARD EVALUATION
(Use Supplemental Sheets if Necessary)

Summary (attach copy of available chemical information from Saxs, Merck, Index, Ohmtads, etc.): Non-specific organic compounds

General industrial solvents: Trichloroethylene
Perchloroethylene

Heavy Metals: Lead
Mercury

Non-specific herbicide (Containing Mercury circa 1971)

See attachments for hazard evaluation and data sheets

D. SITE SAFETY WORK PLAN

PERIMETER ESTABLISHMENT: Map/Sketch Attached? Yes Site Secured? Yes

Perimeter Identified? NO Zone(s) of Contamination Identified? NO

This task will identify the perimeters and extent of contamination. Borings to be made outside of contaminated material.

PERSONAL PROTECTION:

Level of Protection: A ____ B ____ C X D X

Modifications: Upgrade to Level C for samples with positive HNU readings. Level C for monitoring all drilling.

Surveillance Equipment and Materials: HNU with 10.2 eV probe.
tace) TLD Badge
Rad mini particle counter

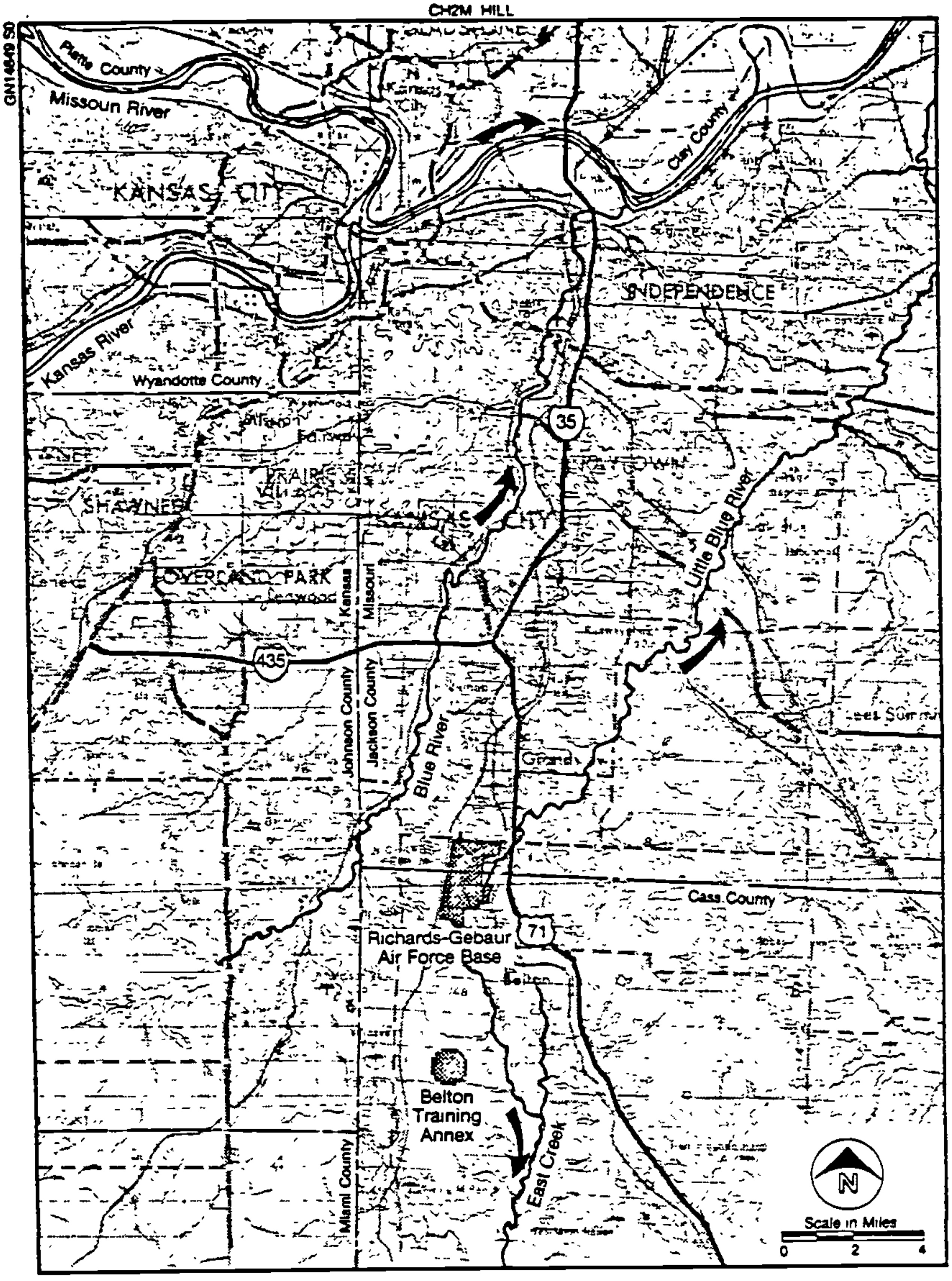

FIGURE 2. Location map of Richards-Gebaur AFB, Missouri.

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ecology and environment

SPECIAL SITE CONSIDERATIONS: See Hazard Evaluation for specific areas of site and the associated hazards.

DECONTAMINATION PROCEDURES:

Personal: Wash boot and gloves with soap and water. Launder coveralls upon return from the field. All Personnel should shower immediately upon return home.

Equipment: Detergent wash, water rinse

INVESTIGATION - DERIVED MATERIAL DISPOSAL: (Note - If material is proposed to be left on site, written authorization is to be received by the Project Team Leader prior to the initiation of on site activities): Disposable material will be double bagged and left on the base. Suspected contaminated soils will be drummed and stored at the base.

SITE ENTRY PROCEDURES: Coordination with base security.
Safety meeting each morning.
No special proceedures required.

Team Member	Responsibility
Paul Kopsick	Co-Project Mgr./Team Leader
James Jackson	Co-Project Mgr./Admin.
Mark Mayo	Field Tech./SSC
Joe Chandler	Field Tech./SSC
Mila Michalowski	Field Tech.
John Cook	Field Tech.
Sharon Martin	Geophysics

7/84 Revised [illegible]

E. EMERGENCY INFORMATION

(Use Supplemental Sheets if Necessary)

EMERGENCY PRECAUTIONS

Acute Exposure Symptoms	First Aid
Irritation of eyes, nose & throat.	
Headache, nausea.	
*Environmental concentrations normally give no acute exposure symptoms.	

LOCAL RESOURCES
(Name, Address and Phone Number)

Ambulance 911

Hospital Emergency Room 942-4400 - St. Joseph Hospital

Poison Control Center 1-234-3000 - Childrens Mercy Hospital

Police (incl. Local, County Sheriff, State) 911

Fire Department 911

Airport Richards Gebaurs AFB

Explosives Unit N/A

Agency Contact (EPA, State, Local, USCG, etc.) Diana Bailey 236-2856

Local Laboratory NONE

UPS/Federal Express 6600 College Blvd. - (across from Black & Veatch) East of Metca

Client Contact Cpt. Patrick Johnson, OEHL TX 1-800-821-4528

SITE RESOURCES

Water Supply Base Civil Engineer John Hurd

Telephone 816-348-2076

Radio

Other

Attachment 3:

Site Safety Briefing Forms

ecology and environment, inc.

ON-SITE SAFETY MEETING

Project ____________________

Date ____________ Time ____________ Job No. ____________

Address ____________________

Specific Location ____________________

Type of Work ____________________

____

____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment ____________________

____

Chemical Hazards ____________________

____

Physical Hazards ____________________

____

Emergency Procedures ____________________

____

Hospital/Clinic ____________ Phone ____________

Hospital Address ____________________

Special Equipment ____________________

____

Other ____________________

____

ATTENDEES

Name Printed	Signature

Meeting Conducted By: ____________ ____________

Name Printed Signature

Site Safety Officer ____________ Team Leader ____________

378103

Emergency Contacts

1. Mr. Raymond Harbison (University of Arkansas) .... (501) 661-5766 or 661-5767
   (501) 370-8263 (24 hour)

2. Ecology and Environment, Inc., Safety Coordinator/
   Dr. Paul Johnmaire .... (716) 632-4491 (office)
   (716) 655-1260 (Home)

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

   What to Report:

   - State: "This is an emergency."
   - Your name, region, and site.
   - Telephone number to reach you.
   - Your location.
   - Name of person injured or exposed.
   - Nature of emergency.
   - Action taken.

2. One of three toxicologists (Drs. Raymond Harbison, Richard Freeman, or Robert James) will contact you. Repeat the information given to the answering service.

3. If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

   E & E Corporate Headquarters (EST 0830-1700) - (716) 632-4491

   a. Twenty-four hour line - (716) 631-9530
   b. Corporate Safety Director - Paul Johnmaire - 716/655-1260 (Home)
   c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-0084)

Emergency Routes

Directions to Hospital (incl. MAP) Andrews Rd. to Outer Belt Road. Outer Belt Road to St. Joseph's Hospital. Hospital is on South side of road.

Other

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F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

LEVEL A

Item	
SCBA	___
SPARE AIR TANKS	___
ENCAPSULATED SUIT	___
SURGICAL GLOVES	___
NEOPRENE SAFETY BOOTS	___
BOOTIES	___
GLOVES (TYPE ________)	___
OUTER WORK GLOVES	___
HARD HAT	___
CASCADE SYSTEM	___
________	___
________	___
________	___
________	___

LEVEL B

Item	
SCBA	___
SPARE AIR TANKS	___
CHEMICAL RESISTANT COVERALLS	___
PROTECTIVE COVERALL (TYPE ________)	___
RAIN SUIT	___
BUTYL APRON	___
SURGICAL GLOVES	___
GLOVES (TYPE ________)	___
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	
BOOTIES	
HARD HAT WITH FACE SHIELD	___
CASCADE SYSTEM	___
MANIFOLD SYSTEM	___

LEVEL C

Item	
ULTRATWIN RESPIRATOR	X
POWER AIR PURIFYING RESPIRATOR	___
CARTRIDGES (TYPE GMC-H)	X
ROBERTSHAW ESCAPE MASK	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X
RAIN SUIT	___
BUTYL APRON	___
SURGICAL GLOVES	X
GLOVES (TYPE Nitrile/Butyl)	X
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	X
HARD HAT WITH FACE SHIELD	X
Booties	X

LEVEL D

Item	
ULTRA-TWIN RESPIRATOR (AVAILABLE)	X
CARTRIDGES (TYPE GMC-H)	X
ROBERTSHAW ESCAPE MASK (AVAILABLE)	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X
RAIN SUIT	___
NEOPRENE SAFETY BOOTS	X
BOOTIES	X
WORK GLOVES	___
HARD HAT WITH FACE SHIELD	X
SAFETY GLASSES	X
________	___
________	___

7/84 Revised JLJ

INSTRUMENTATION		DECON EQUIPMENT (CONT.)	
OVA		PLASTIC SHEETING	
THERMAL DESORBER		TARPS	
O2/EXPLOSIMETER		TRASH BAGS	X
EXPLOSIMETER CALIBRATION KIT		TRASH CANS	
HNU	X	MASKING TAPE	
~~MICROREEN ATT~~ Rad Mini	X	DUCT TAPE	X
MAGNETOMETER		PAPER TOWELS	
PIPE LOCATOR		FACE MASK	X
WEATHER STATION		FACE MASK SANITIZER	X
DRAEGER PUMP		FOLDING CHAIRS	
BRUNTON COMPASS		STEP LADDERS	

FIRST AID EQUIPMENT		SAMPLING EQUIPMENT	
FIRST AID KIT	X	Drill Rig (Subcontract)	X
OXYGEN ADMINISTRATOR			
STRECHER			
PORTABLE EYE WASH			
BLOOD PRESSURE MONITOR			
RADIATION BADGES	X		
FIRE EXTINGUISHER	X		

DECON EQUIPMENT	
WASH TUBS	X
BUCKETS	
SCRUB BRUSHES	X
PRESSURIZED SPRAYER	X
DETERGENT (TYPE Alconox)	X
SOLVENT (TYPE Hexane or 1,1,1 TCE	X

7/84 Revised CLJ

APPENDIX A
STATEMENT OF MEDICAL FITNESS

This is to confirm that the following employees may be engaged in field activities at ________________ in connection with the Subcon-
(name of site)
tract Agreement between E & E and ________________, dated _________, 19__, and that all of said employees are medically fit both to perform required field activities and to utilize respiratory equipment in accordance with 29 CFR, Part 1910 and "USEPA Standard Operating Safety Guides," 1984.

____

____

____

____

____

____
Authorized Subcontractor Representative

EXPOSURES/INJURIES

ONSITE EXPOSURES OR INJURIES:

* should be given appropriate medical attention. Hospital care for chemical exposures must be coordinated with Doctor Harbison (501) 370-2863 (24 hrs)

* injuries without exposures should be given appropriate medical attention

* all exposures/injuries must be reported to the regional office within twenty-four hours (24 hrs)

OFFSITE INJURIES

I. IF AN INJURY OCCURS WHILE YOU ARE "OUT OF TOWN" FOR THE PURPOSES OF SITE WORK, the injury is given appropriate medical attention and reported to the Region Office within 24 hours .

II. IF AN INJURY OCCURS WHILE USING EQUIPMENT OWNED OR OPERATED FOR E&E, the injury should be treated and reported within 24 hours.

II. IF THE INJURY OCCURRED ON YOUR OWN TIME, AND HAS NOTHING TO DO WITH E&E PROPERTY OR EQUIPMENT, report the injury to the Regional Program Manager (Jim Buchanan or his designeee Bill Kwoka) if:

* Medication is being taken
* The injury may adversely affect job performance including your ability to work in the field, at the garage, driving, etc.

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Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

   What to Report:

   - State: "This is an emergency."
   - Your name, region, and site.
   - Telephone number to reach you.
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   - Name of person injured or exposed.
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   - Action taken.

   One of three toxicologists (Drs. Raymond Harbison, Richard Freeman, or Robert James) will contact you. Repeat the information given to the answering service.

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* Medication is being taken
* The injury may adversely affect job performance including your ability to work in the field, at the garage, driving, etc.

FIELD SAFETY DATA SHEET

Chemical Name: Mercury Compounds (Inorganic)

(* 1)CAS NO: 7439-97-6 M.W.: ________ Phys. State Solids
(* 1)TLV 0.05 Mg/m3 (ppm or MG/M3)(*)Ceiling Limit ________ (ppm or MG/M3)

APPEARANCE:
(*)Pure: ________
(*)Soil: ________
(*)Water: ________

ODOR:
(*)Odor Threshold ________ (ppm or MG/M3)
(*)Odor Description No odor expected

DETECTION:
(*)HNU Detection Efficiency: 0 (10.2 EV Probe) Assumed
(*)OVA Detection Effiency: 0 Assumed
(*)Other Detection Methods: Mini ram particle counter for sites
COMMENTS: where Environmental concentrations are less than 15,000 PPM

PROTECTIVE EQUIPMENT: Mg/m3
(*) 0 TO 0.005 Level-D
(*) .005 TO 0.05 Level-C (Cartridge GMC-H) AP-3
(*) ____ TO ____ Level-B
(*) Above ____ Level-A

Action Levels can be changed by the RSC to reflect the maximum anticipated concentrations

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion
(* 2)Acute Effects: kidney damage anorexia, muscle tremors, Neurotic disorders
(* 2)Chronic Effects: Digestive + Nervous system Ailments, Gingivitis

Other Hazards: Ignit no Flam no Oxid no Corr Yes
Explosive possible Toxic YES Carcin NO Radio NO
Terat ____ Repro ____ Muta ____

(*)Vapor Density >air (*) B.P. ________ (*) LEL NA
(*)Soluble (H2O) YES (*) Specif. Grav. ________ (*) UEL NA

DECONTAMINATION: ________

(*) FIRST AID: ________

REFERENCE SECTION:

1). ACGIH TLVs 1983-1984
2). ILO Encyclopedia of Occupational Health + Safety
3).
4).
5).
6).
7).
8).
9).
10).

FIELD SAFETY DATA SHEET

Chemical Name: Lead and its Compounds (inorganic only)

(*1)CAS NO: 7439-02-1 M.W.: ________ Phys. State solid

(*1)TLV 0.15 (ppm or MG/M3)(*)Ceiling Limit 0.45 (ppm or MG/M3)

TWA 0.05 mg/M3 (*)IDLH ________

APPEARANCE:

- (*2)Pure: various solids
- (*2)Soil: indistinguishable except at high concentrations
- (*2)Water: indistinguishable except at high concentrations.

ODOR:

- (*)Odor Threshold ________ (ppm or MG/M3)
- (*2)Odor Description none- metallic taste at high conc.
- (* 2) Vapor Pressure insignificant except at high temp.

DETECTION:

- (*2)HNU Detection Efficiency: 0 (10.2 EV Probe)
- (* 2)OVA Detection Effiency: 0
- (*)Other Detection Methods: Atomic absorption or ICAP

COMMENTS: Human Health Effects at blood Pb = 20 micrograms/dl (Ref5) [hypertension]

PROTECTIVE EQUIPMENT: mg/m3

(* 3)	0 TO .002	Level-D	
(* 3)	.002 TO .02	Level-C	(Cartridge type-H) or GMC-H
(* 3)	.02 TO ____	Level-B	
(*)	Above ____	Level-A	

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(*4)Acute Effects: Fatigue, sleep disturbance, headache, muscle aches alters blood forming tissues, impairs enzymes

(*4)Chronic Effects: nerve and brain damage

Other Hazards:

Ignit no	Flam no	Oxid no	Corr no
Explosive no	Toxic no	Carcin no	Radio no
Terat ____	Repro ____	Muta ____	

(* 4)Vapor Density na	(* 4) B.P. various	(*) LEL NA
(*4)Soluble (H2O) varies	(* 4) Specif. Grav. =11	(*) UEL NA

DECONTAMINATION: Soap & Water

(*) **FIRST AID:** ________

REFERENCE SECTION:

1). ACGIH, TLV'S 1983-1984
2). Professional Judgement
3). Corporate Guidelines
4). ILO, Encyclopedia of Occupational Health & Safety
5). Environmental Reporter 5/31/85 p197
6).
7).
8).
9).
10).

FIELD SAFETY DATA SHEET

Chemical Name: ORGANIC VAPORS NOS

(*)CAS NO: N/a M.W.: ______ Phys. State ______
(*)TLV ______ (ppm or MG/M3)(*)Ceiling Limit ______ (ppm or MG/M3)

APPEARANCE:
(*)Pure: ______
(*)Soil: ______
(*)Water: ______

ODOR:
(*)Odor Threshold ______ (ppm or MG/M3)
(*)Odor Description ______

DETECTION:
(*)HNU Detection Efficiency: 30-50% assumed (10.2 EV Probe)
(*)OVA Detection Effiency: 50% assumed
(*)Other Detection Methods: ______

COMMENTS: ______

PROTECTIVE EQUIPMENT:
(*1) 0 TO 1 ppm Level-D
(*1) 1 TO 5 ppm Level-C (Cartridge combination organic/ high efficiency filter
(*) ____ TO ____ ppm Level-B
(*) Above ____ ppm Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(* 2)Acute Effects: nausea unknown, headache, eye, nose & throat irritation
(*)Chronic Effects: ______

Other Hazards: Ignit yes Flam yes Oxid no Corr no
Explosive no Toxic yes Carcin yes Radio no
Terat yes Repro yes Muta yes

(*)Vapor Density ______ (*) B.P. ______ (*) LEL ______
(*)Soluble (H2O) ______ (*) Specif. Grav. ______ (*) UEL ______

DECONTAMINATION: Soap & water wash, water rinse. Assumes properties similar to the most common solvents.

(*) FIRST AID: no special actions.

REFERENCE SECTION:
1). Corporate guidelines
2). other values are assumed based upon the solvent properties
3). most often encountered in field work.
4). ______
5). ______
6). ______
7). ______
8). ______
9). ______
10). ______

HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV) AND SOURCE 50 ppm TWA 150ppm STEL ACGIH 1982

EFFECTS OF OVEREXPOSURE Inhalation of TCE above the TLV can irritate nose & throat, with dizziness, drowsiness, headache, nausea, unconsciousness, & even death resulting from excessive exposure. Eye irritation and lacrymation can result from exposure to vapor or liquid. Skin contact causes irritation and, when prolonged or repeated, dermatitis. *

EMERGENCY FIRST AID PROCEDURES Eye Contact: Wash immediately with plenty of running water. Continue washing to minimize discomfort. Get prompt medical attention. Skin Contact: Remove contaminated clothing. Wash with soap & warm water. Inhalation: Remove to fresh air; restore breathing if required. Keep at rest & warm. Immediately contact physician; advise him not to give adrenalin. Ingestion: Get immediate medical help. Do not induce vomiting unless directed by a physician. (Authorities differ; professional decision required).

VIII REACTIVITY DATA

UNSTABLE	STABLE	CONDITIONS TO AVOID
☐	☒	

INCOMPATIBILITY (MATERIALS TO AVOID) Reacts with NaOH, KOH, or other strong alkali to form explosive mixtures of chloroacetylenes.

HAZARDOUS DECOMPOSITION PRODUCTS Requires stabilization against oxidation, degradation & polymerization. When exposed to high temperatures, hydrogen chloride & phosgene (highly toxic).

HAZARDOUS POLYMERIZATION	MAY OCCUR	WILL NOT OCCUR	CONDITIONS TO AVOID
	xx	☐	

IX SPILL OR LEAK PROCEDURES

PROCEDURES TO CONTAIN AND CLEAN UP LEAKS AND SPILLS Clean up personnel should use respiratory & liquid contact protection. Provide ventilation. Confine spill to as small an area as possible. Do not allow run off to the sewer. Pick up spill with vacuum or on an absorbent & store in closed container for disposal.

REPORTING PROCEDURE

WASTE DISPOSAL METHOD Waste can be processed to recover TCE, or it can be burned in an appropriately equipped, high temperature incinerator. Disposal through a licensed waste disposal company should also be considered. Follow Federal, State & local regulations.

X PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE) Use self-contained breathing equipment above 1000 ppm; canister respirators for limited exposures

VENTILATION		
	LOCAL EXHAUST	SPECIAL
	MECHANICAL (GENERAL)	OTHER

PROTECTIVE GLOVES Neoprene gloves, aprons, etc.

EYE PROTECTION Gas-tight goggles should be used by maintenance & emergency personnel.

OTHER PROTECTIVE EQUIPMENT AND CLOTHING An eyewash station should be available where splashing is probable.

XI SPECIAL PRECAUTIONS

HANDLING AND STORAGE CONDITIONS Store in a cool, well-ventilated area & use with adequate ventilation, including floor level ventilation. No smoking in use or storage areas. Avoid collecting aluminum fines or chips in vapor degreaser. Regularly monitor TCE stabilizer level. Only trained personnel should operate vapor degreaser.

OTHER

XII INFORMATION SUBMITTED BY

NAME	DATE 2/83
COMPANY	SOURCES OSHA

CONTINUATION/NOTES

*Ingestion irritates the digestive tract & may cause nausea & rapid drowsiness partial paralysis, unconsciousness & kidney failure can result in severe cases.

CHEMSAFE™ MATERIAL SAFETY DATA SHEET

10 123

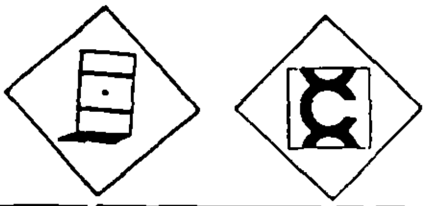
I IDENTIFICATION

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO
ADDRESS (Number Street City State and ZIP Code)	CAS NUMBER 000 079 016
CHEMICAL NAME AND SYNONYMS Trichloroethylene	TRADE NAME AND SYNONYMS
CHEMICAL FAMILY Chlorinated Alkene	FORMULA ClHCCCl$_2$

II CHEMSAFE™ INSTRUCTIONAL* CLASSIFICATION

Affix Appropriate Chemsafe™ Instructional Classification Label

*Refer to CHEMSAFE™ instructional booklets for data regarding the properties, appropriate safe use and storage, and emergency response for this class of substance



III HAZARDOUS INGREDIENTS

INGREDIENT NAME	%	TLV AND SOURCE (units)	INGREDIENT NAME	%	TLV AND SOURCE (units)
1 Trichloroethylene	100	50 ppm TWA	4		
2		ACGIH	5		
3		1982	6		

IV PHYSICAL DATA

Boiling Point at 760 mm Hg 1 atm, deg F (C)	188 (87)	Specific Gravity (H_2O = 1) 20 C	1.45-1.47*
Vapor Pressure (mm Hg at 20 ° C) mm Hg	58	Percent Volatile By Volume (%)	ca 100
Vapor Density (Air = 1)	4.54	Evaporation Rate (Butyl Acetate = 1) (CCl_4=1)	-0.69
Solubility in Water (% by Weight) @ 25°C, %	0.1	Melting Point (°F)	NA

Appearance and Odor: Colorless, mobile liquid with a characteristic, sweet, ether-like odor whose recognition threshold is 21.4 ppm in air (unfatigued, 100% of test panel). *Depends on stabilizer & level used.

V FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Flammable Limits in Air (% by Volume)	Lower (Lel)	Upper (Uel)
None			

Extinguishing Media: Use that which is appropriate for surrounding fire. Trichloroethylene is normally considered noncombustible. However, when 15% vapor in air at 33C is exposed to

Fire Fighting Procedures: intense heat (electric arc) or to ordinary flame at vapor-air temps. exceeding 50C, it can be made to burn mildly. Combustibility increases in O_2 enriched air.

Self-contained breathing apparatus should be used for protection against TCE vapors & their toxic & corrosive decomposition products in a fire situation.

Fire and Explosion Hazards

VI LOCATIONS USED AND STORED (Completed By User)

Locations Used

Locations Stored

CHEMSAFE™ FORM 32

(Continued on reverse side)

SPRINGBORN REGULATORY SERVICES, INC
THIRTY SPRINGBORN CENTER
ENFIELD, CONNECTICUT 06082

FIELD SAFETY DATA SHEET

Chemical Name: Perchloroethylene syn. tetrachloroethylene

(*1)CAS NO: 127-18-4 M.W.: 166 Phys. State liquid
(*1)TLV 50 PPM (ppm or MG/M3)(*)Ceiling Limit 200 PPM ppm or MG/M3)
IDLH 500 PPM (ref 4)

APPEARANCE:
(*)Pure: colorless to pale yellow liquid
(*)Soil:
(*)Water:

ODOR:
(*)Odor Threshold ______ (ppm or MG/M3)
(*4)Odor Description similar to chloroform

DETECTION:
(*2)HNU Detection Efficiency: ______ (10.2 EV Probe) I.P. 9.32
(*2)OVA Detection Effiency: 70%
(*2)Other Detection Methods: Drager tubes, Gas Chromatography

COMMENTS:

PROTECTIVE EQUIPMENT:
(*3) 0 TO 5 ppm Level-D
(*3) 5 TO 50 ppm Level-C (Cartridge Combination: Organic High efficiency filter
(*) ___ TO ___ ppm Level-B
(*) Above ___ ppm Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(*4)Acute Effects: irritation of eyes, nose throat, CNS depressant
(*4)Chronic Effects: liver and kidney damage

Other Hazards: Ignit no Flam no Oxid no Corr no
Explosive no Toxic yes Carcin ___ Radio no
Terat ___ Repro ___ Muta ___

(*)Vapor Density ______ (* 4) B.P. 250°F (*) LEL na
(*4)Soluble (H20) 1,500 (* 5) Specif. Grav. 1.62 (*) UEL na

DECONTAMINATION: soap and water wash, water rinse

(*) FIRST AID: Take victim to fresh air and remove contaminated clothing. Give artificial respiration if necessary.

REFERENCE SECTION:
1). ACGIH, TLVs 1984-1985
2). Manufacturer's Literature
3). Corporate Guidelines
4). Niosh / Osha Pocket Guide to Chemical Hazards 1980 revision
5).
6).
7).
8).
9).
10).

HAZARD EVALUATION:

This project has several phases. The phases include surface soil sampling, subsurface soil sampling, sediment sampling , surface water sampling and groundwater sampling. The subsurface sampling efforts will include subcontractors to drill borings and/or install monitoring wells.

Hazards Present:

volatile organic compounds: Inhalation hazard

- paint thinners and solvents
  - generally a mixture of aliphatic organics and aromatic compounds
- degreaser and solvents for the removal of paint
  - generally chlorinated volatile organic compounds such as trichloroethene, methylene chloride, 1,1,1-trichloroethane.

Non-volatile organics:

- direct contact hazard
- generally petroleum products for vehicle fuels, lubrication although they can be considered to be direct contact hazards, they generally have low toxicity.

Pesticides: direct contact hazard

- The pesticides which are reported to have been disposed of on this site are limited to a mercury containing compound which was used as a herbicide. No other description of the herbicide was made. It is assumed that the compound will be toxic by direct contact only and will probably not be an acetocholinesterase inhibitor since the mercury compounds are not associated with organophosphate or organocarbamate pesticides.

  Other pesticides are in use on the air base at the present time but are not believed to be in the landfill areas. The present pesticides include several of the acetanilide derivatives, and organophosphates and organochlorine compounds. One of the named compounds was Silvex. Silvex is a 2,4,5-T formulation and has the potential for TCDD contamination.

  At this time, no PCBs or Dioxins are known to be or thought to be on the site in the areas of investigation.

Physical hazards:

- The physical hazards associated with this site will be greatest around the drill rig operation. All utility lines pipes etc. will be located prior to the start of drilling. At least two people will be present at the drill rig while it is in operation. The route to the nearest hospital will be explained to the drillers and/or an E&E person familiar with the route will be present.
- constant monitoring of the breathing zone will be performed during the drilling operations. Additional monitoring will be done to detect potentially high concentrations which could reach the breathing zone.

Hazard Evaluation at Richards-Geb.auer AFB (continued):

The overall hazards consist of the following:

Inhalation: volatile organic compounds (including carcinogens)
Heavy metals (particulates)
Pesticides

Direct ContacT:
Volatile Organics
Carcinogens: chlorinated organics (volatile)
Pesticides
Mercury (from pesticide)
Lead (from Paint)

- Level-C protection is recommended for those activities which disturb the subsurface soils and for the collection of soil samples which have the potential for contamination with the mercury containing herbicide or carcinogens. GMC-H cartridges.
- Skin protection should include disposable outerwear to protect against particulates. Since the drillers will not drill into the fill material, no direct contact with concentrated chemicals is anticipated.

ACTION LEVELS:

If the HNU/OVA measures organic vapor concentrations in excess of five parts per million above background, the team is to withdraw from the site. Site work is not to continue until the respiratory protection is increased or enough information is provided to the Regional Safety Coordinator for him to determine that level-C respiratory protection is still appropriate. Level-B operation requires the approval of the RSC.

If above background levels of radiation are detedted in any of the areas, the work is to stop for that area until the hazard is evaluated and approval is granted.

Subcontracts:

As of 9-12-86 the subcontract has not been finalized. The Statements of medical fittness must be recieved for this safety plan to be valid for subcontract work. The subcontractors must also be informed to the hazards and monitoring antiuipated to be present/done.

Site Number one:

The only anticipated wastes which are hazardous are:
paints
paint thinner
  alcohol
  aliphatic organics
  turpentine
Strippers
  chlorinated hydrocarbons such as
    TCE
    Carbon tetrachloride
    1,1,1-Trichloroethane

The quantities are reportedly very small. This is partly due to the practise of burning the solvents rather than just landfilling them.

ACTION LEVELS:
1 PPM organic vapors goto Level-c protection
5 PPM organic vapors withdraw from the site area
Above Background Radiation: Withdraw from the area and report the situation to the RSC.

Site Number 2 (The Northeast Landfill)

Hazardous wastes are present in very small quantities. The volatiles which were disposed of were not containerized. Waste paint and thinners were spread on the ground surface until 1978. Since no concentrated wastes are known to be containerized in the disposal area, high concentrations of vapors are very unlikely.

Action Levels: Same as for site NO.1

Note: Over 400 55-gallon drums are stored at the site. Most of the drums are empty, but some of the drums have unknown contents. If the wind direction places the site downgradient of the drums, there is potential for exposures through leakage and other releases. Inform the team/drillers of that potential and withdraw if unexpected odors occur or if there is irritation of mucus membranes such as in the nose or throat. Eye irritation or headaches are also common signs of exposure.

Site Number 5, The South Burn Pit:

Thissite was used to burn oil and solvents during training exercises for firefighting personnel. Although there is potential for volatile organica to be present here, the quantities are anticipated to be small due the history.

Level-D respiratory protection is recommended unless the organic vapor concentrations exceed 1 PPM.above background.

Site Number 6: The North Burn Pit:

Hazardous wastes:
- -Waste oils
- -Solvents
- -Fuels: only JP-4 fuel similar to kerosene

History is the same as for site 5. Use the same respiratory guidelines.

Site Number 8, The Herbicide Burial Site:

Hazardous Wastes:
- -four cases of mercury containing herbicide estimated to be less than 50 pounds total
- - no description of the chemical or its trade name.

It will be assumed that the bottles are intact or that they have been broken by their burial. Since the herbicide is in pint bottles, it is unlikely that the borings will break more than one or two. Visu al observation is very important if the perimeter is not well defined. If the perimeter is well defined, there is no chance of striking the bottles.

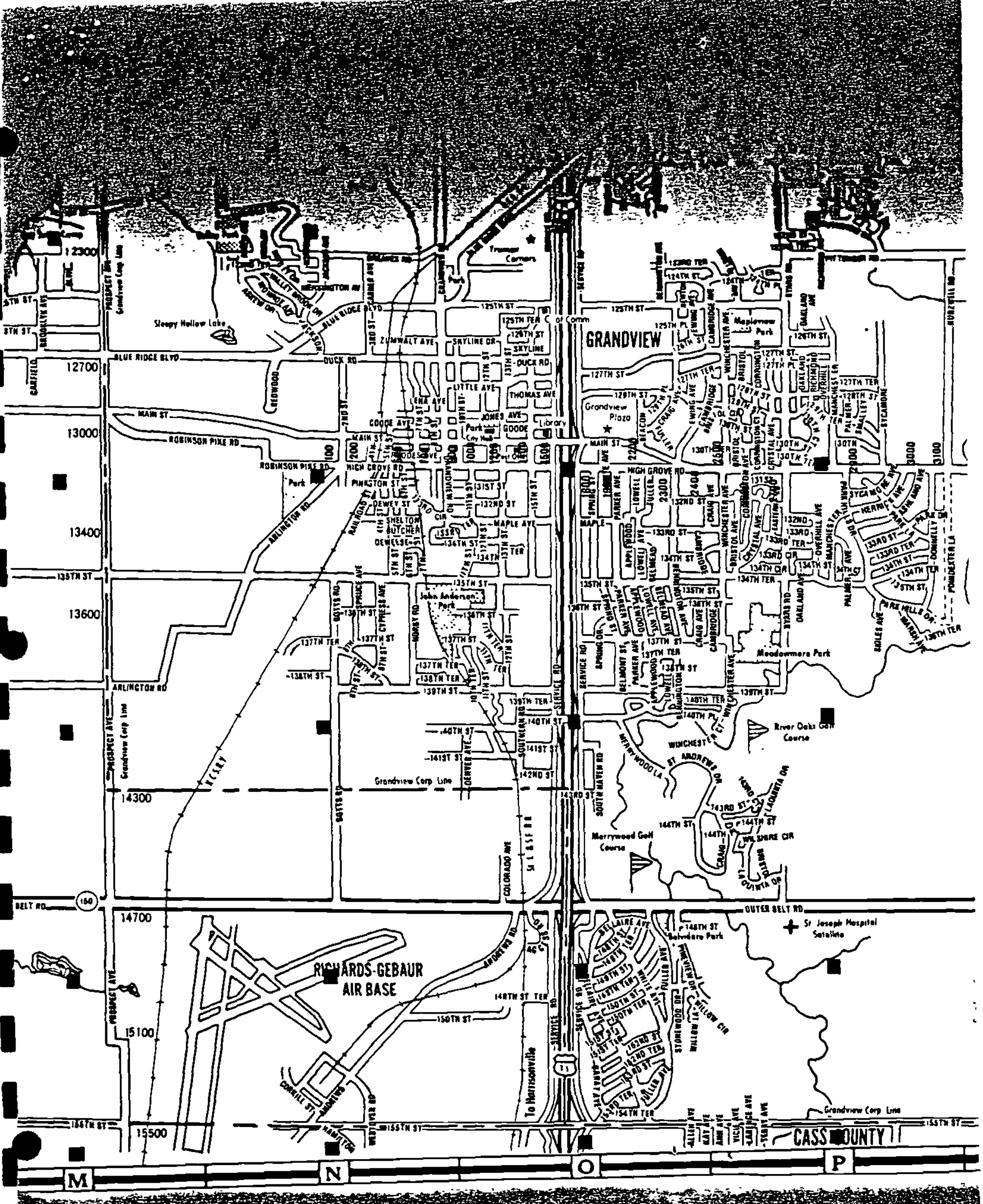
In the event that the perimeter is poorly defined, the drillers and monitoring personnel should take particular care to examine soil cuttings for signs of organics. The signs could include a sheen on the water/soil, odors like solvents, fragments of broken glass, etc. Since the characteristics of the herbicide are not defined it is not known if the HNU or OVA will respond to it. For the purposes of this safety plan, we are assuming that both instruments will not detedt the pesticide. You are to assume that the herbicide is present.

Hand protection will consist of surgical gloves under nitrile or butyl gloves. Foot protection will be a minimum of rubber boots (safety). Outerwear should be disposable coveralls such as tyvek or saranex suits.

Site Number 9, An Oil Saturated Area

An oil contaminated area is located in an area which was previously used for storage of petroleum products such as fuels, oils and greases.

This area is reported to have been heavily contaminated by relatively non-toxic materials. Due to the nature of the contaminants, and the fact that the site is in an open area, respiratory protection will not be required. Respiratory protection is optional at organic vapor concentrations which reach 5 PPM.


GRANDVIEW
RICHARDS-GEBAUR AIR BASE
CASS COUNTY
Sleepy Hollow Lake
Truman Corners
C of Comm
Maplewood Park
Grandview Plaza
Library
John Anderson Park
Meadowmere Park
River Oaks Golf Course
Merrywood Golf Course
St Joseph Hospital Satellite
Belvidere Park
To Harrisonville
Grandview Corp Line
BLUE RIDGE BLVD
MAIN ST
ROBINSON PIKE RD
HIGH GROVE RD
ARLINGTON RD
135TH ST
139TH ST
OUTER BELT RD
BELT RD
155TH ST
PROSPECT AVE
SERVICE RD
12300
12700
13000
13400
13600
14300
14700
15100
15500
M
N
O
P

APPENDIX B

CONTRACT DESCRIPTION OF WORK

17 JUN 1986

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 2)
RICHARDS-GEBAUR AFB MO

10 132

I. DESCRIPTION OF WORK

The overall objective of the Installation Restoration Program (IRP) Phase II investigation is to assess potential contamination at past hazardous waste disposal and spill sites on Air Force installations. A series of staged field investigations may be required to meet this objective.

The intention of this staged investigation is to undertake a field and laboratory study at Richards-Gebaur AFB MO to: (1) confirm the presence or absence of contamination within the specified areas of investigation; (2) if possible, determine the extent and degree of contamination and the potential for migration of those contaminants in the various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on state or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

The IRP Phase I Report and Phase II Stage 1 Report (mailed under separate cover) incorporate the background and description of the sites/zones for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. General Requirements

1. Conduct a literature search of local hydrogeologic conditions to complement the Phase I and Phase II Reports (mailed under separate cover). Include the pertinent literature search information in an appendix of the Final Report. Develop the literature search data using the following guideline:

a. Topographic data

b. Geologic data

(1) Structure

(2) Stratigraphy

(3) Lithology

c. Hydrogeologic data

(1) Location of all existing and abandoned wells, observation wells, springs, ponds (natural and artificial) and seepages, that occur on or off the installation within a one-mile radius of sites to be investigated

(2) Groundwater table and piezometric contours

(3) Depth to groundwater

(4) Surface and groundwater quality

(5) Delineated areas of recharge, discharge and contributing areas

(6) Geologic setting, yield data and hydrographs of springs and natural seepages

d. Data on all existing and abandoned wells, including uncased boreholes, on or off the installation and within a one-mile radius of sites to be investigated

(1) Location, depth, diameter, well type, and lithologic logs associated with the well

(2) Static and pumping water levels, well hydrographs, yield, specific capacity, and related data

(3) Existing and projected groundwater development and use

(4) Well and screen corrosion, crustation, and similar operation and maintenance problems

(5) Observation and monitoring well networks, pumping influences, barrier and recharge boundaries, and related hydraulic interferences influencing aquifer behavior.

(6) Existing water sampling sites

e. Aquifer data

(1) Type, i.e., unconfined, artesian, or perched

(2) Thickness, depth to aquifer, and formational designation

(3) Barrier and recharge boundaries

(4) Transmissivity, storativity, and permeability (gpd/ft^2)

(5) Specific retention

(6) Delineation of discharge and recharge areas

(7) Ground and surface water relationships

(8) Aquifer models

f. Climatic data

(1) Precipitation (total and net)

(2) Evapotranspiration

2. Determine the areal extent of the sites by reviewing historical and current panchromatic and infrared aerial photography.

B. Technical Operations Plan

Immediately after the Notice To Proceed (NTP) for the delivery order, develop a Technical Operations Plan (TOP) based on the technical requirements specified in this task description. (See Sequence No. 19, Item VI below). Follow the TOP format (mailed under separate cover). Provide the TOP to the USAFOEHL within two weeks of the NTP.

C. Health and Safety

Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection needed at the study sites. Prepare a written Health and Safety Plan for the proposed work effort and coordinate it directly with applicable regulatory agencies prior to commencing field operations. Provide an information copy of the Health and Safety Plan to the USAFOEHL after coordination with regulatory agencies. The Health and Safety Plan is specified in Sequence No. 7, Item VI below.

D. Drilling and Soils Work

1. Determine the exact location of all monitor wells, soil borings, and test pits during the planning/mobilization phase of the field investigation. Consult with base personnel to minimize disruption of base activities, to properly position wells with respect to exact site locations, and to avoid underground utilities. Direct the drilling and sampling and maintain a detailed log of the conditions and materials penetrated during the course of the work. Do not drill boreholes into or position wells in actual landfill areas, install wells at the landfill perimeter.

2. Monitor the ambient air during all well drilling, soil boring and test pit work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs. If soil encountered during borehole drilling or test pit work is suspected to be hazardous because of abnormal discoloration, odor or air monitoring levels, containerize the soil cuttings in new, unused drums. Enter into the boring logs the depth(s) from which suspected contaminated soil cuttings were collected for containerization. Collect a maximum of 10 composite samples, one from the contents of each drum. Test each composite sample for EP Toxicity (metals). Use RCRA criteria to determine if soil cuttings must be classified as hazardous waste (40 CFR 261.24).

3. Groundwater Monitoring Wells

a. Installation of Groundwater Monitoring Wells

(1) Comply with U.S. EPA Publication 330/9-S1-002, NEIC Manual for Ground Water/Subsurface Investigations at Hazard Waste Sites for monitoring well installation.

(2) All well drilling, development, purging, sampling methods, and other activity pertaining to this effort must conform to state and other applicable regulatory agency requirements. Cite references in an appendix to the Final Report.

(3) Install wells at a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present.

(4) Avoid, when possible, installing wells in depressions or areas subject to frequent flooding and standing water. If wells must be installed in such areas, design the wells such that standing water does not leak into the top of the casing or cascade down the annular space.

(5) Drill all monitoring wells using the following specifications:

(a) Drill wells using hollow-stem auger techniques. A center stem, plug, and bit attached to the stem may be inserted into the auger for use while drilling. This will prevent material from entering into the hollow stem of the auger.

(b) Take lithologic samples at five-foot intervals and prepare borehole log descriptions. Include pilot boring logs and well completion summaries in the Final Report (Item VI, below).

(c) Drill a maximum of 6 wells. Total footage for all wells in this task shall not exceed 200 linear feet. Refer to the site specific details in Section I.H.

(d) Construct each well with four-inch inside diameter (I.D.) Schedule 80 PVC casing. Use threaded screw-type joints, glued fittings are not permitted. Flush thread all connections. Screen each well using four-inch I.D. casing having up to 0.020 inch slots; slot size may be smaller based upon borehole geology. Screen material must be the same as that of the casing. Cap the bottom of the screen.

(e) Screen all wells so as to collect floating contaminants and to allow for yearly fluctuations of the water table. Screen all shallow wells a minimum of ten feet.

(6) Complete all monitoring wells using the following specifications:

(a) Once the casing is installed, allow the soil formation to collapse around the well screen. Supplement the natural gravel-pack with washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two feet above the top of the screen. Tremie a five foot bentonite seal (granulated or pellets) above the sand/gravel pack. Ensure the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with a Type I Portland cement/bentonite slurry.

(b) Check with the Base point of contact (POC) to determine whether wells shall be completed flush or project above the ground surface.

1 If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and install a protective locking lid consisting of a cast-iron valve box assembly. Center the lid assembly in a three foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid.

2 If an above-ground-surface completion is used, extend the well casing two or three feet above land surface. Provide an end-plug or casing cap for each well. Shield the extended casing with a steel guard pipe which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid on the guard pipe. Install three, three-inch diameter steel guard posts if the Base POC determines the well is in an area which needs such protection. The guard posts shall be five feet in total length and installed radially from each wellhead. Recess the guard posts approximately two feet into the ground. Do not install the guard posts in the concrete pad placed at the well base. Paint the protective steel sleeve and clearly number the well on the sleeve exterior.

3 Provide locks for both flush and above-ground well assemblies. Turn over the lock keys to the Base POC following completion of the field effort.

(c) Develop each well as soon as practical after completion with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible. Measure the rate of water produced, the pH, specific conductance and water temperature during well development and include this information in the Final Report.

(d) Determine by survey the elevation of all newly installed monitoring wells to an accuracy of 0.01 foot. Notch the top of the riser casing where well elevations are established. Horizontally locate the new wells to an accuracy of 1.0 foot and record the position on both project and site-specific maps. Bench marks used must have previously been established from and are traceable to a USCGS or USGS survey marker.

(e) Measure water levels at all monitoring wells as feet below the ground surface or below the top of casing elevation to the nearest 0.01 foot. Report as mean sea level (MSL). Measure static water levels in wells prior to well development and before all well purging which precedes sampling events.

b. Recommend a candidate well abandonment method(s) or technique(s) which is applicable to the type of monitoring wells installed and geological conditions. Consider that these wells will be abandoned at some future date after the study objectives have been met and there is no longer a need for the wells. The actual process of well abandonment is not a part of this task order. Assure that the recommended method(s) meets state and/or local well abandonment guidelines or regulations.

c. Complete permits, applications, and other documents which may be required by local and/or state regulatory agencies for the installation of monitoring wells. File these documents with appropriate agencies and pay all permitting and filing fees.

4. Soil Borings

a. Conduct a maximum of 12 soil borings not to exceed a total of 250 linear feet. Accomplish the borings using hollow stem auger techniques. Obtain split-spoon samples at five foot intervals, using ASTM Method D-1586. Refer to Section I.H. for collection details of soil samples requiring laboratory analysis. Where sample collection depths are not specified, take samples in zones of suspected contamination as determined by abnormal soil discoloration, odor or air monitoring levels.

b. Scan all split-spoon soil cores with a photoionization meter or equivalent organic vapor detector. Include monitoring results in the boring logs.

c. During the boring operations, describe lithologies encountered and prepare stratigraphic logs. Place special emphasis on field identification of contaminated soils encountered.

d. Whenever possible, measure water levels in all boreholes after the water level has stabilized. Examine the water surface for the presence of hydrocarbons. Include this information in the boring logs.

e. Tremie-grout all boreholes to the surface with bentonite. It is especially important to insure that they be adequately resealed to preclude future migration of contaminants.

f. Permanently mark each location where soil borings are drilled. Record the location on a project map for each specific site or zone, whichever is applicable.

g. Perform a maximum of three shallow soil augerings using a hand auger. Total footage shall not exceed 50 feet.

5. Well and Borehole Cleanup

Remove all well/borehole cuttings and clean the general area following the completion of each well/borehole. Containerize and store cuttings suspected to be contaminated according to paragraph I.D.2. of this task order. Transport these drums to a location within the installation boundary designated by the Base POC. The base is responsible for ultimate disposal of contaminated soils using base resources.

E. Decontamination Procedures

1. Decontaminate all sampling equipment, including internal components, prior to use and between samples to avoid cross-contamination. Wash equipment with a laboratory-grade detergent followed by drinking quality water, solvent (methanol), and distilled water rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely before reuse.

2. Dedicate for each well the monofilament line or steel wire used to lower sampling equipment into the well; do not use a line in more than one well. Decontaminate the calibrated water level probe for measuring well volume and water level elevation before use in each well.

3. Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated sites, if possible.

F. Field Sampling

1. Strictly comply with the sampling techniques, maximum holding times, and sample preservation as specified in the following references: Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), pages 37-44; ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition (USEPA, 1984); Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pages xiii to xix (1983); and the Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA Document 600/4-82-029 (1982).

2. Groundwater Monitoring Wells

a. After development, allow wells to stabilize for a minimum of seven days before sampling.

b. Prior to purging the wells, examine the surface of the water table for the presence of hydrocarbons and take water level measurements to the nearest 0.01 foot with respect to the established survey point on top of the well casing. If applicable, measure the thickness of the hydrocarbon layer.

c. Purge the well using a submersible pump, bailer, or other pertinent method. Purge until a minimum of three well volumes (based on borehole diameter) of water has been displaced and the pH, temperature, specific conductance, color, and odor of the discharge have stabilized using the following criteria: pH ± 0.1 unit; temperature ± 0.5°C, and specific conductance ± 10 µmhos. Include the final measurements in the Results section of the report.

d. Collect water samples with a Teflon bailer. However, to collect representative aquifer samples where floating hydrocarbons are present, use a "thief sampler" or similar device to minimize the influence of the free product.

e. If the well(s) cannot be sampled due to well development, well characteristics, or other reason(s), indicate the reason(s) in the report as specified in Item VI below.

f. Remeasure water levels after sampling and the wells have stablized.

3. For surface water/sediment samples, collect samples so as not to cause cross-contamination; obtain downstream samples first. Measure, on site, the pH, temperature, and specific conductance for all water samples.

4. Permanently mark the location where surface water or sediment samples are collected. Record the location on a project map for each specific site or zone, whichever applies.

5. Split all water and soil samples. Analyze one set and immediately deliver the other set (the same collection day) to the Base POC. The Base POC will select 10% of the split samples, package the selections with appropriate forms, and deliver them to the contractor within 24 hours of receipt. Supply all packing and shipping materials to the Base POC for packaging the split samples. Immediately ship (within 24 hours) the POC-selected samples through overnight delivery to:

USAFOEHL/SA
Bldg 140
Brooks AFB TX 78235-5501

For all split samples sent to the USAFOEHL, complete an AF Form 2752A "Environmental Sampling Data" and/or an AF Form 2752B "Environmental Sampling Data - Trace Organics", (working copies will be provided under separate cover) with the following information:

a. Date and time collected

b. Purpose of sample (analyte and sample group)

c. Installation name (base)

d. Sample number

e. Source/location and depth of sample

f. Contract Task Numbers and Title of Project

g. Method of collection (bailer, suction pump, air-lift pump, etc.)

h. Volumes removed before sample taken (well samples only)

i. Special conditions (use of surrogate standard, etc.)

j. Preservatives used

k. Collector's name or initials

In addition, label each sample container with a permanent ink pen (water-proof laundry marker) to reflect the data in a, b, c, d, j and k above.

6. For every 10 field samples collected, take at least one additional sample (a field duplicate) for quality control purposes. Table 1 provides a 10% allowance for these additional analyses. Duplicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

7. For every 20 field water samples collected, prepare and submit for analysis one field blank for all parameters analyzed in water. A minimum of one field blank for each parameter is required. Allowances for these additional analyses are included in Table 1.

8. Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

G. Chemical Analyses

1. Analyze water and soil samples collected as specified in Section H below, Specific Site Work. The analytical parameters are summarized in Table 1 along with the required methods.

2. All analyses shall meet the required limits of detection for the applicable method identified in Table 1.

3. For those methods which employ gas chromatography (GC) as the analytical technique (SW8010, SW8020, E601, E602, E604, etc.) positive confirmation of identity is required for all analytes having concentrations higher than the Method Detection Limit (MDL). Conduct positive confirmation by second-column GC; however, gas chromatography/mass spectroscopy (GC/MS) can be used for positive confirmation if the quantity of each analyte to be confirmed is above the detection level of the GC/MS instrument. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of

the report, but results of all second-column GC or GC/MS confirmational analyses are to be included in the report appendix along with other raw analytical data. Base the quantification of confirmed analytes on the first-column analysis. The maximum number of second-column confirmational analyses shall not exceed fifty percent (50%) of the actual number of field samples (to include duplicates). The total number of samples for each GC method listed in Table 1 includes this allowance. If GC/MS, or a combination of second-column GC and GC/MS, is used, the total cost of all such analyses for a particular parameter shall not exceed the funding allowed for positive confirmation using only second-column GC.

4. All chemical/physical analyses shall conform to state and other applicable Federal and local regulatory agency legal requirements. If a regulatory agency specifies that a type of analysis be performed in a certified laboratory, assure compliance with the requirement and furnish documentation showing laboratory certification with the first analytical data supplied to the USAFOEHL/TS.

5. Archive all raw data, including QA/QC and standards data, for not less than five years after project completion. Supply these data to the USAFOEHL/TS upon request.

H. Specific Site Work

In addition to items delineated in I.A. through I.G. above, conduct the following specific actions at the sites listed below:

1. South Landfill (Site 1)

a. Perform one soil boring to an approximate depth of 15 feet. Obtain a maximum of 3 soil samples from the boring. The selection of soil samples for chemical analysis shall be based on OVA or HNU meter readings, discoloration, odor, or other signs of contamination. Record the OVA/HNU readings and other observations with the soil boring logs. Take a water sample from the boring if groundwater is encountered.

b. Take a maximum of three soil or sediment samples along the perimeter of the landfill along Scope Creek. Take one background soil or sediment sample upstream of the landfill along the creek.

c. Take a maximum of three water samples from Scope Creek adjacent to the landfill or from any leachate seeps detected. Take one background water sample upstream along Scope Creek.

d. Analyze soil/sediment samples for petroleum hydrocarbons, aromatic volatile organics and halogenated volatile organics.

e. Analyze water samples for petroleum hydrocarbons, total dissolved solids (TDS), halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols.

2. Northeast Landfill (Site 2)

a. Locate and review any available new information dealing with the Northeast Landfill and nearby sewer lines. Locate and interpret any aerial photographs of the site when it was in operation.

b. Perform a magnetometer and an electromagnetic survey of the site.

c. Perform six soil borings each approximately 20 feet deep, three borings for the west trench and three borings for the double trench. Obtain a maximum of 3 soil samples per boring (a maximum of 18 total soil samples). Select the soil samples based on OVA or HNU meter readings, discoloration, odor or other signs of contamination. Obtain a water sample from each boring if water is encountered (a maximum of 5 water samples (Note: One boring will be coverted to a well).

d. Convert one boring into a monitoring well immediately downgradient of the newly discovered trench areas in the west part of the landfill. Install one background monitoring well immediately north of the landfill. Collect a water sample from each well.

e. Collect water samples from the three existing monitoring wells at the site.

f. Collect water samples from Scope Creek upgradient and downgradient of this landfill (2 samples).

g. Analyze soil samples for petroleum hydrocarbons, aromatic volatile organics, and halogenated volatile organics.

h. Analyze water samples for petroleum hydrocarbons, TDS, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols.

3. North Burn Area (Site 6)

a. Perform soil gas analysis with a maximum of 30 holes/probes to characterize contamination from the site. Siting of borings and wells will be based on the results of the soil gas survey.

b. Perform three soil borings each approximately 15 feet deep along the perimeter of the pit. Obtain a maximum of 9 soil samples from the boreholes based on OVA/HNU meter readings, discoloration, odor, or other indications of contamination. Collect a water sample from each borehole if water is encountered for a maximum of three water samples.

c. Install 3 wells. Two of the wells shall be installed downgradient of the site and the other upgradient. Each well shall be sampled once for a total of three water samples.

d. Obtain six composite soil surface samples to a depth of 12 inches covering the area of overflow and along the surface drainage pathway.

e. Collect one surface water sample from any ponded water in the drainage pathways.

f. Analyze the soil samples for petroleum hydrocarbons, aromatic volatile organics and halogenated volatile organics.

g. Analyze water samples for petroleum hydrocarbons, aromatic and halogenated volatile organics.

4. Herbicide Burial Area (Site 8)

a. A maximum of four composite soil samples will be taken from areas of stressed vegetation. One water sample will be taken from the small pond which drains the site.

b. Analyze the soil samples for herbicides (EPA 8150), arsenic and mercury.

c. Analyze the water sample for pesticides (EPA 608, 509A, and 509B) arsenic, mercury, and TDS.

5. Oil Saturated Area (Site 9)

a. Perform 1 soil boring approximately 15 feet deep. Obtain a maximum of 3 split spoon soil samples for analysis based on OVA or HNU meter reading, discoloration, odor, or other indications of contamination. Collect a water sample from the borehole if water is encountered.

b. Collect a maximum of six composite surface soil samples from the area draining the oil saturated zone.

c. Collect a water sample from the surface water drainage pathway downgradient from the site.

d. Analyze the soil samples for petroleum hydrocarbons, lead and halogenated and aromatic volatile organics.

e. Analyze water samples for petroleum hydrocarbons, lead, TDS, and halogenated and aromatic volatile organics.

6. Hazardous Waste Drum Storage Area, Bldg 923 (Site 10)

a. Perform one soil boring inside the compound near the stained area approximately 15 feet deep. Obtain a maximum of 3 soil samples from the boring. Obtain a water sample from the borehole if water is encountered.

b. Collect six surface soil samples, one from the stained area, four downgradient, and one upgradient from the stained area.

c. Collect a maximum of two surface water samples from the surface drainage pathway, one upgradient and one downgradient from the stained area. The surface drainage pathway will only be sampled if water is present during fieldwork.

d. Analyze soil samples for petroleum hydrocarabons, EP toxicity (metals), and halogenated and aromatic volatile organics.

e. Analyze water samples for petroleum hydrocarbons, TDS, priority pollutant metals, barium, mercury and halogenated and aromatic volatile organics.

7. POL Storage Area (Site 12)

a. Hand auger three borings at locations selected in the field for a maximum of 30 feet of hand augering. Collect a maximum of 3 soil samples from each boring. Selection of samples will be based on indications of contamination detected in the field.

b. Install one downgradient well to an approximate depth of 20 feet. Collect one water sample from the well.

c. Collect two soil/sediment samples, one from each of the outfall drains from Bldg 953.

d. Collect three surface water samples, two from the stream draining the POL tank area and one from the drain outfall from Bldg 953.

e. Analyze the four water samples for petroleum hydrocarbons, TDS, and aromatic volatile organics.

f. Analyze soil samples for petroleum hydrocarbons and aromatic volatile organics.

I. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, as they become available and incorporate them into the next monthly R&D Status Report (Sequence No.1, Item VI below) forwarded to the USAFOEHL. In addition to the results, report the following:

a. the time and dates of sample collection, extraction (if applicable) and analysis;

b. the method used and Method Detection Limits achieved;

c. the chain-of-custody forms;

d. a cross-reference of laboratory sample numbers and field sample numbers; and

e. a cross-reference of field sample numbers to wells, boreholes, sites, etc.

2. Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report (Sequence No. 3, Item VI below) and forward the report to USAFOEHL for review a minimum of two weeks prior to submission of the draft report. Provide as a minimum the information specified in I.I.1 above.

3. Immediately report to the USAFOEHL Program Manager or his supervisor, via telephone, data/results generated during this investigation which indicate a potential health risk (for example, a contaminated drinking water aquifer). Follow the telephone notification with a written notice within three days; attach a copy of the laboratory raw data (e.g., chromatogram).

J. Reporting

1. Prepare a draft report delineating all findings of this field investigation and forward it to the USAFOEHL (as specified in Sequence No. 4, Item VI below) for Air Force review and comment. Strictly adhere to the USAFOEHL report format (mailed under separate cover). The format is an integral part of this delivery order. Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by Air Force officials. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. Include, as a minimum, discussion of the regional/site-specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality and soil analysis results, available geohydrologic cross-sections, and laboratory and field QA/QC information. For states requiring the field work or technical effort be supervised by a state-registered geologist, engineering geologist or professional engineer, insert this information in the report to include registration numbers, certificates and seals (as appropriate).

2. Review the Results, Conclusions and Recommendations concerning the sites listed in this task which were investigated during a previous IRP Phase II staged work effort. Use this information and data from previous efforts to establish trends and develop conclusions and recommendations. Integrate all investigative work done at each site to date so the report reflects the total cumulative information for each site studied in this effort.

3. In the Results section, include water and soil analytical results and field quality control sample data. Report all internal laboratory quality control data (lab blanks, lab spikes and lab duplicates) and laboratory quality assurance information in an appendix of the report. Also provide second-column confirmation results and quantities, and include which columns were used, instrument operating conditions, and retention times. Summarize in the appendix the specific collection technique, analytical method (Standard Methods, EPA, etc.), holding time, and limit of detection for each analyte .

4. Make estimates of the magnitude, extent and direction which detected contaminants are moving. Identify potential environmental

consequences of the discovered contaminants based upon state or Federal standards.

5. Plot and map all field data collected for each site according to surveyed positions.

6. In the Recommendation section, address each site and list them by category:

a. Category I consists of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable public health or environmental hazards.

b. Category II sites are those requiring an additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Identify potential environmental consequences of discovered contamination.

c. Category III sites are those that will require remedial action (ready for IRP Phase IV). In the recommendations for Category III sites, include a discussion of any possible influence on sites in Categories I and/or II due to their connection with the same hydrological system. Clearly state any dependency between sites in different categories. Include a list of candidate remedial action alternatives, including long term monitoring (LTM) as remedial action, and the corresponding rationale that should be considered in selecting the remedial action for a given site. List all alternatives that could potentially bring the site into compliance with environmental standards. For contaminants that do not have standards, EPA-recommended safe levels for noncarcinogens (Health Advisory or Suggested-No-Adverse-Response Levels) and target levels for carcinogens (1×10^{-6} cancer risk level) may be used. Unless specifically requested, do not perform any cost analyses, or cost/benefit review for remedial action alternatives. However, in those situations where field survey data indicate immediate corrective action is necessary, present specific, detailed recommendations.

7. For each category above, summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations. Reduce this summary information into a table (or tables) and insert it (them) into the text and the Executive Summary.

8. Provide cost estimates by line item for future efforts recommended for Category II sites and LTM Category III sites. Submit these estimates concurrently with the approved Final Report in a separate document. Only the cost requirements outlined in Sequence No. 2, Item VI, need be submitted.

a. For Category II sites, develop detailed site-specific estimates using prioritized costing format (i.e., cost of conducting the required work on: the highest priority site only; the first two highest priority sites only; the first three highest priority sites only; etc., until all required work is discretely costed) for the proposed work effort. The Air Force determines the priority of sites from contractor recommendations.

Consider the type of contaminants, their magnitude, the direction and rate of their migration, and their subsequent potential for environmental and health consequences when developing recommendations for site prioritization.

b. For Category III sites slated for long term monitoring, develop site specific estimates which detail the costs associated with: (1) permanent installation of monitoring wells; (2) ground water sampling interface equipment, including permanent installation of pumps and sampling lines; and (3) four quarterly (1 year period) sample collections and laboratory chemical analyses of groundwater, etc.

9. Provide an inventory of all on-base wells, to include production, irrigation, monitoring, etc. If the well has been abandoned, note the reason, and identify those wells which have been permanently plugged or sealed.

10. Reference in an appendix any local, state and/or Federal regulations which require specific well drilling techniques, materials, well development, purging, and sampling methods for work specified in this effort.

K. Meetings

The contractor's project leader shall attend three meeting(s) to take place at a time to be specified by the USAFOEHL. Each meeting shall take place at Richards-Gebaur AFB for a duration of one eight-hour day.

II. SITE LOCATION AND DATES:

Richards-Gebaur AFB MO
Date to be established

III. BASE SUPPORT:

A. The Base Point of Contact (POC) will receive from the contractor the split samples and then select 10% of them, package them, and then deliver them back to the contractor within 24 hours for subsequent overnight shipment to USAFOEHL/SA as stated in paragraph I.A.6.

B. Base personnel will assign the disposal points within the installation for all hazardous drill cuttings and contaminated groundwater. Assignment shall occur prior to drilling.

C. Base personnel will provide access to all sites. This may necessitate the clearance of small areas to permit set-up and operation of drilling rigs and equipment.

D. Base personnel will provide traffic control where/when necessary during geophysical surveys or well construction on or adjacent to road rights-of-way.

E. Base personnel will ensure rights of easement and any other required licenses are obtained across private properties so as to perform nondestructive geophysical explorations, the boring and construction of one or more monitoring wells, and other investigations that may be required in performance of this investigation.

F. Base personnel will designate a staging area on base for the contractor's drilling equipment and supplies. An area will also be designated where the contractor can decontaminate his drilling equipment between wells.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. USAFOEHL Technical Program Manager
Capt PatrickN. Johnson
USAFOEHL/TSS
Brooks AFB TX 78235-5501
(512) 536-2158
AUTOVON 240-2158/2159
1-800-821-4528

2. Base Point of Contact (POC)
Ms Felipita B. Benson, R.N.
Occupational Health Nurse
442 Combat Support Group (AFRes)
Richards-Gebaur AFB MO 64030-5000
AUTOVON 463-2144
(816) 348-2144

3. MAJCOM Monitor
Lt Col Victor E. Hiatt
HQ AFRes/SGPB
Robins AFB GA 31098-6001
AUTOVON 468-6441
(912) 926-6441

4. Base Civil Engineer POC
Mr John Hurd
422 Combat Support Grup (AFRes)
Richards-Gebaur AFB MO 64030-5000
(816) 348-2076

VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, which apply to all orders, the sequence numbers listed below are applicable to this order. Also shown are dates applicable to this order.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
19 (TOP)*	I.B.	OTIME	19SEP86	19SEP86		15
7 (Health & Safety)	I.C.	OTIME	19SEP86	19SEP86		3
3 (Prelim Data)	I.I.2	OTIME	**	**		3
4 (Tech. Rpt)	I.J.	ONE/R	4MAR87	18MAR87	16SEP87	***
2 (cost data)	I.J.8.	OTIME	2SEP87	16SEP87		****
14		MONTHLY	12SEP86	12SEP86	*****	3
15		MONTHLY	12SEP86	12SEP86	*****	3

*The Technical Operations Plans (TOP) required for this stage is due within two weeks of the Notice to Proceed.

**Upon completion of the total analytical effort and before submission of the first draft report.

***Two draft reports (25 copies of each) and one final report (50 copies plus the original camera ready copy) are required. Incorporate Air Force comments into the second draft and final reports as specified by the USAFOEHL. Supply the USAFOEHL with an advance copy of the first draft, second draft, and final reports for acceptance prior to distribution. Distribute the remaining 24 copies of each draft report and 49 copies of the final report as specified by the USAFOEHL.

****Submit cost estimates (five copies) in a separately bound document with the Final Report only. Provide estimates for only those sites recommended for additional Phase II work (Category II) or Phase IV, long term monitoring, (Category III).

*****Submit monthly hereafter.

Table 1 JO 150

Analytical Methods, Detection Limits, and Number of Samples

Parameter	Method	Detection Limit	No. of Samples	QA	Total Samples
Halogenated Volatile Organics	SW5030/SW8010	a	58 soil	6 soil	96 soil[d]
	EPA 601	a	29 water	4 water	50 water[e]
Aromatic Volatile Organics	SW5030/8020	a	69 soil	7 soil	114 soil[f]
	EPA 602	a	33 water	5 water	57 water[g]
Extractable Priority Pollutants (GC/MS)	EPA 625	a	17 water	3 water	20 water
Phenols	E604	a	17 water	3 water	30 water[h]
Petroleum hydrocarbons	EPA 418.1 modified for soils	1 mg/Kg	69 soil	7 soil	76 soil
	EPA 418.1	1 mg/L, water	33 water	6 water	39 water
Total Dissolved Solids (TDS)	EPA 160.1	10 mg/L, water	34 water	6 water	40 water
Priority Pollutant Metals (13 ea)	EPA 200.7	a	20 water	3 water	23 water
	EPA 245.1(Hg)	1.0 µg/L	20 water	3 water	23 water
	EPA 206.2(As)	1.0 µg/L	20 water	3 water	23 water
	EPA 270.2(Se)	2.0 µg/L	20 water	3 water	23 water
Arsenic	EPA 206.2 SW 3050/SW7060	1.0 µg/L 0.1 mg/Kg	1 water 4 soil	0 water 1 soil	1 water 5 soil
Barium	EPA 200.7	a	3 water	2 water	5 water
Lead	EPA 239.2 SW3050/7420	a a	2 water 9 soil	1 water 1 soil	1 water 10 soil
Mercury	EPA 245.1 SW 7471	1.0 µg/L 0.1 mg/Kg	4 water 4 soil	1 water 1 soil	5 water 5 soil

Common Anions	A429	a	17 water	3 water	20 water
Pesticides	EPA 608	a	1 water	1 water	3 water
	A 509A	a	1 water	1 water	3 water
	A 509B	a	1 water	1 water	3 water[i]
	SW8150	a	4 soil	1 soil	8 soil[j]
pH (field test)			34 water		34 water
Temperature (field test			34 water		34 water
Conductance (field test)			34 water		34 water
EP Toxicity (metals)	SW Manual	b	19 soil	2 soil	21 soil

[a]Detection limits specified by the EPA or Standard Method

[b]

Metal	mg/L of leaching solution
As	0.002
Ba	0.1
Cd	0.005
Cr	0.05
Pb	0.1
Hg	0.0002
Se	0.002
Ag	0.01

[c]Not used.

[d]Total of 96 includes second column confirmation for 50% of the samples (32).

[e]Total of 50 includes second column confirmation for 50% of the samples (17).

[f]Total of 114 includes second column confirmation for 50% of the samples (38).

[g]Total of 57 includes second column confirmation for 50% of the samples (19).

[h]Total of 30 includes second confirmation for 50% of the samples (10).

[i]Total of 3 includes second column confirmation of 50% of the samples (1).

[j]Total of 8 includes second column confirmation for 50% of the samples (3).

ATTACHMENT 1
SAMPLING AND ANALYTICAL REQUIREMENTS

SOIL

SITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Nonhalogenated Volatile Organics	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Herbicide, As, Hg	EP Toxicity (Metals)				
Site 1	7	7			7									
Site 2	18	18			18									
Site 6	15	15			15									
Site 8									4					
Site 9	9	9			9			9						
Site 10	9	9			9					9				
Site 12		11			11									
	58	69			69			9	4	9				

ATTACHMENT 1
SAMPLING AND ANALYTICAL REQUIREMENTS

WATER

SITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Pesticides As, Hg	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Phenols	Common Anions	Ba	Hg	pH	Temperature	Conductance
Site 1	5	5		5	5	5	5		5	5			5	5	
Site 2	12	12		12	12	12	12		12	12			12	12	1
Site 6	7	7			7	7							7	7	
Site 8			1			1							1	1	
Site 9	2	2			2	2		2					2	2	2
Site 10	3	3			3	3	3				3	3	3	3	
Site 12		4			4	4							4	4	
	29	33	1	17	33	34	20	2	17	17	3	3	34	34	3