FINAL

WORK PLAN

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY

CD LANDFILL NAVAL BASE, NORFOLK, VIRGINIA

CONTRACT TASK ORDER 0138

03.05-07/01/93-0061/

Prepared For:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under the:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared By:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

JULY 13, 1993

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

A Work Plan, Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP) have been prepared for the Remedial Investigation/ Feasibility Study (RI/FS) for the CD Landfill. The plans document the scope and objectives of the RI/FS activities as well as the procedures to be used, the resources needed, and the rationale for the tasks to be undertaken. These documents insure that all necessary planning and review has been performed before field work begins.

This document presents the Final Work Plan for Contract Task Order 0138, Remedial Investigation/Feasibility Study, Remedial Action Plan and Record of Decision for the CD Landfill, Naval Base, Norfolk, Virginia. Baker Environmental, Inc. is the prime contractor for the Comprehensive Long-Term Environmental Action Navy Program (Navy CLEAN) under which this project is being performed. Figure 1-1 presents the Site Location Map and Figure 1-2 presents the CD Landfill Site Map.

1.1 Previous Investigations

Previous investigations of hazardous waste sites at the Naval Base, Norfolk, Virginia have been conducted under an Initial Assessment Study, Interim Sampling Program, Confirmation Study, and Expanded Site Inspection.

In April 1982, an Initial Assessment Study (IAS) was conducted at the Sewell's Point Naval Complex, Norfolk Naval Base, Norfolk, Virginia. The IAS identified 18 sites of concern with regard to potential contamination. The CD Landfill (Site 6) was included as a potential area of concern.

Prior to conducting a Confirmation Study at the CD Landfill, an Interim Sampling Program was performed. Surface water and sediment were sampled quarterly and then semiannually from 1983 to 1985. A Confirmation Study of the CD Landfill site was conducted by the Navy in 1987.

An Expanded Site Investigation of the CD Landfill site was conducted by Environmental Science and Engineering, Inc. (ESE) from February 1990 to June 1991. Twelve subsurface soil samples (two samples per boring) were collected from six well borings. Groundwater monitoring wells were installed at three locations in order to monitor the water table aquifer.

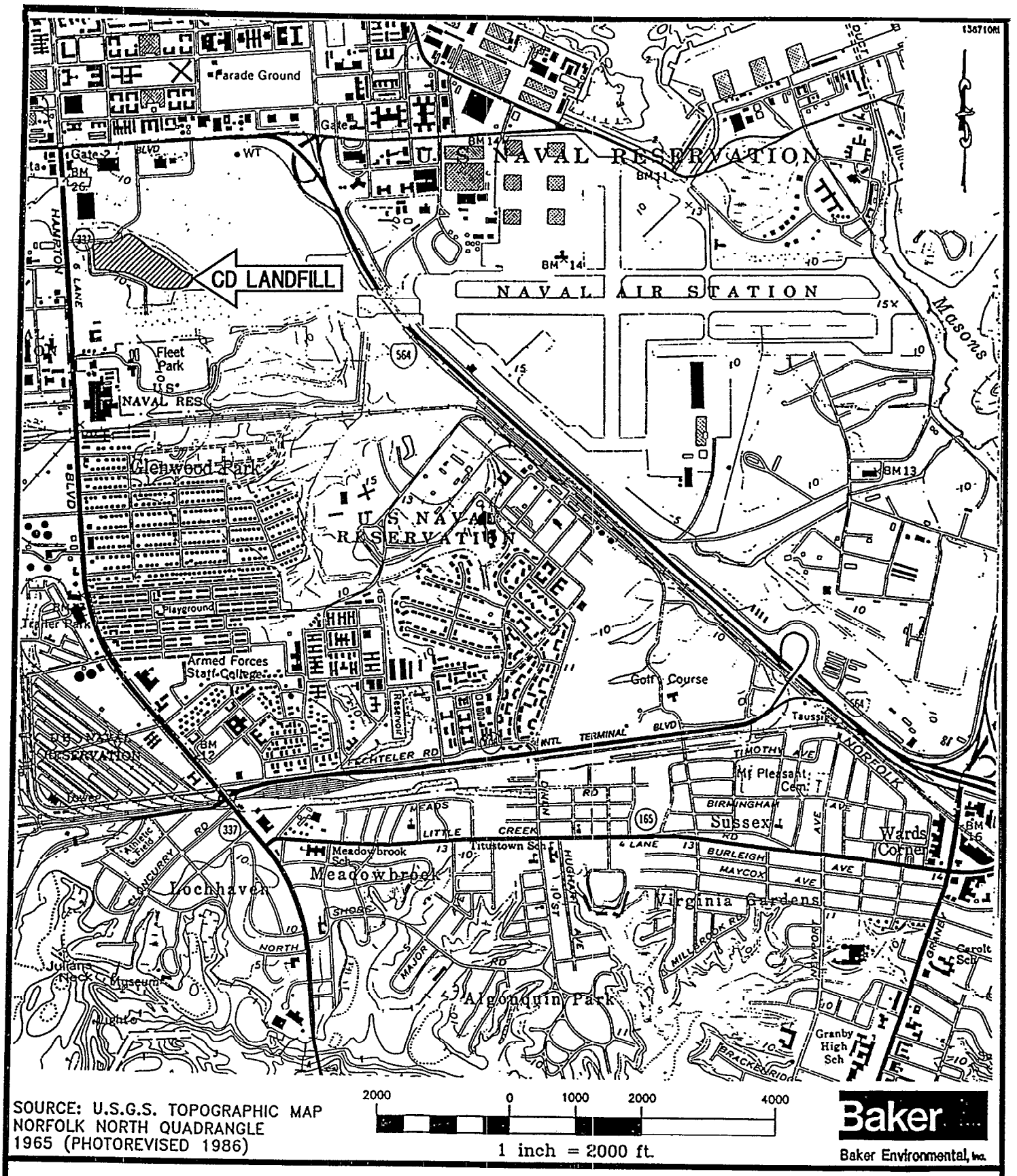


FIGURE 1-1
LOCATION MAP
CD LANDFILL SITE

NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

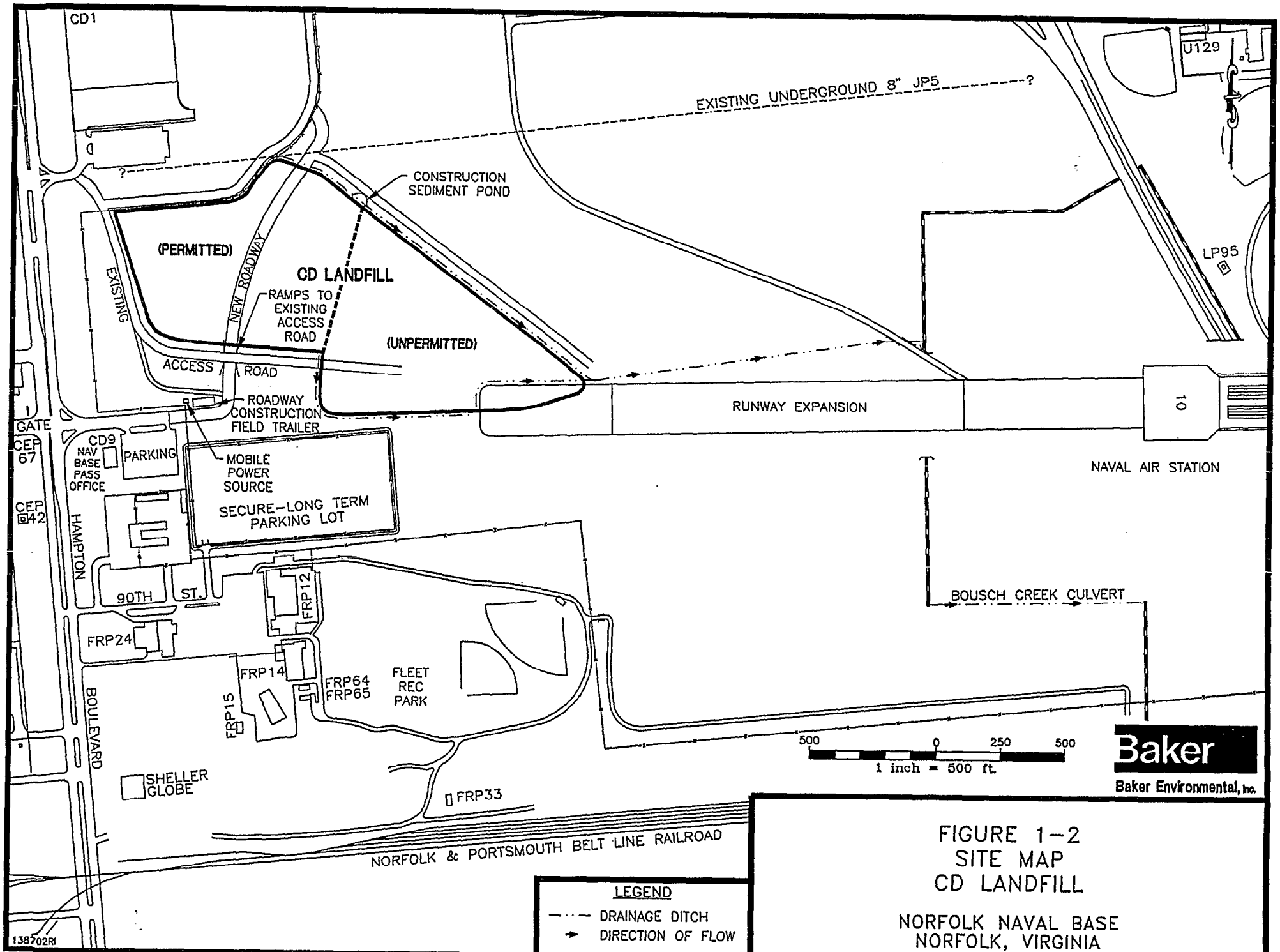


FIGURE 1-2
SITE MAP
CD LANDFILL

NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

Two rounds of sediment and surface water samples were collected at five locations, as well as two rounds of groundwater samples from the six monitoring wells.

As a result of the Superfund Amendments and Reauthorization Act of October 1988 (SARA), the Navy has changed its program to follow rules, regulations, guidelines, and criteria established by the Environmental Protection Agency (EPA) for the Superfund Program. Included will be a Technical Review Committee (TRC) meeting composed of representatives from EPA, state and local governments, and the local community.

1.2 Description of the Current Study

The current study at the CD Landfill is intended to complete the characterization of environmental impacts resulting from past disposal activities at the CD Landfill. The objectives of the project are to:

- Determine the nature and extent of contamination.
- Identify possible migration pathways and resulting impacts on environmental and human populations.
- Assess risk to human health and the environment.
- Obtain data for the development of remedial action alternatives.
- Evaluate the alternatives in terms of health, welfare, and environmental impact.

1.3 Applicable or Relevant and Appropriate Requirements (ARARs)

SARA Section 121(d) requires the attainment (or justification of a waiver) of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) upon completion of a remedial action. State ARARs are to be met when the requirements promulgated are more stringent than Federal laws, and identified by the State. The 1990 National Contingency Plan (NCP) requires compliance with ARARs during remedial actions and at completion of the remediation, as well as compels attainment of ARARs during removal action whenever practicable.

Applicable requirements are defined as those "... cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site" (USEPA, 1988). Relevant and Appropriate Requirements are similarly defined; however, these standards are not applicable to a site (i.e., do not satisfy all the jurisdictional prerequisites of a requirement). Relevant and Appropriate Requirements "... address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (USEPA, 1988). ARARs must be attained for hazardous substances remaining on site at the completion of a remedial action. The determination of which requirements are appropriate and relevant is flexible. EPA and the State may look to the type of remedial actions contemplated, the hazardous substances present, the waste characteristics of the site, and other pertinent site-specific factors. A requirement must both be relevant and appropriate to the specific site to be an ARAR, but it is possible for only part of a requirement to be considered relevant and appropriate.

ARARs are identified on a site-specific basis from three types of ARARs: chemical-, location-, and action-specific. Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values and methodologies (i.e., promulgated standards and risk assessments) establish acceptable concentrations of a chemical contaminant that can be found in the environment. Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because the specific locations are of environmental importance (i.e., wetlands, floodplains, wilderness areas). Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy (i.e., capping, excavation).

Occasionally, ARARs are not sufficient to protect public health or the environment. When this occurs, nonpromulgated standards, criteria, guidance and advisories must be evaluated along with the chosen ARARs to help provide protective target cleanup levels. These types of nonpromulgated standards are referred to as To Be Considered (TBCs) and are not legally binding.

The following is a list of the potential Federal and state ARARs which may be applied to the CD Landfill. Additional state ARARs will be identified as the project progresses.

1.3.1 Chemical-Specific ARARs

- National Primary and Secondary Drinking Water Regulations (Safe Drinking Water Act)
- Federal Ambient Water Quality Criteria (Clean Water Act)
- Water Quality Standards of the Commonwealth of Virginia, VR-680-21-00
- Virginia Air Pollution Control Regulations - VR-120-01 through 120-08
- Other Federal Criteria, Advisories, Guidance and State Standards To Be Considered (i.e., Health Effects Assessments, Reference Doses, Cancer Slope Factors, Health Advisories)
- RCRA MCLs 40 CFR 264 (f) and (s)
- National Ambient Air Quality Standards (Clean Air Act)

1.3.2 Location-Specific ARARs

- Endangered Species Act
- Wilderness Act
- Fish and Wildlife Coordination Act
- Wild and Scenic Rivers Act
- Scenic Rivers Act
- Rivers and Harbors Act
- Coastal Zone Management Act
- Clean Water Act, Section 404 (Wetlands)
- 40 Code of Federal Regulations, Part 6, Appendix A (Floodplain Management and Protection of Wetlands)
- National Historic Preservation Act

- Archaeological and Historic Preservation Act
- VA Wetlands Act, Title 62.1

1.3.3 Action-Specific ARARs

Action-specific ARARs are not usually identified until the Feasibility Study portion of the investigation when potential remedial technologies are screened. However, potential action-specific ARARs include:

- VA Solid Waste Regulations (VR-672-20-10)
- VA Hazardous Waste Management Regulations (VR-672-10-01)
- Underground Injection Control (40 CFR Parts 144 and 147)
- OSHA Requirements (29 CFR Parts 1910, 1926, and 1904)
- DOT Rules for Hazardous Materials Transport (49 CFR Parts 107 and 171.500)
- RCRA Land Disposal Restrictions Requirements (40 CFR Part 268)

The above lists are not yet complete as the investigation has not yet begun. However, these lists are sufficient to focus the implementation of the investigative efforts. Additional ARARs will be added as more information becomes available during the field activities.

1.4 Document Organization and Presentation

This Work Plan discusses the activities proposed for successful implementation of the RI/FS, including report preparation. Section 2.0 of this plan presents the Background and Setting of the study area, Technical Approach, by task, for meeting the project objectives is discussed in Section 3.0. Section 4.0 presents Project Management and Staffing. Sections 5.0 and 6.0 provide Schedule and References, respectively.

Detailed procedures by which these tasks will be performed and the associated quality objectives are presented as Attachments to this Work Plan. These attachments include:

- Attachment A - Health and Safety Plan (HASP)
- Attachment B - Sampling and Analysis Plan (SAP)
- Attachment C - Quality Assurance Project Plan (QAPP)

2.0 BACKGROUND AND SETTING

The area known as the CD Landfill is located approximately 0.5 miles south of Admiral Taussig Boulevard and between the Naval Air Station and Hampton Boulevard, Norfolk Naval Base. The Navy purchased the land in 1974 from the Western Railway Company. The site incorporates two areas of landfill operations; the eastern (unpermitted) section, in operation from 1974 to 1979 and the western (permitted) section, in operation from 1979 to 1987. In 1979, a portion of the southeast corner of the unpermitted section was regraded to allow for runway expansion at the adjacent Naval Air Station. Refer to Figure 1-2, CD Landfill Site Location Map.

2.1 Unpermitted Landfill

The unpermitted portion of the landfill was used for demolition debris and inert solid waste, fly ash, incinerator residue, chemicals, or asbestos material. From 1974 to 1979, ash residues, sandblasting grit and spent rice hulls were deposited in the landfill. High concentrations of cadmium and lead were identified in the waste during previous investigations. In 1979, a portion of the landfill was regraded to facilitate runway expansion. The runway expansion design specified that material was to be spread over the landfill and not removed from the site.

2.2 Permitted Landfill

In October 1979, the Naval Facilities Engineering Command received a permit from the Virginia Department of Health to use the landfill (western portion) for disposal of demolition debris and other non-putrescible wastes excluding fly ash, incinerator residues, chemicals, and asbestos. Blasting grit used for sandblasting cadmium-plated parts was deposited at the landfill until 1981 when the blasting grit was tested and exceeded the EP toxicity limit for cadmium. The grit was classified as a hazardous waste and on-site disposal of the material was ceased.

At present, the majority of the site (approximately 40 acres) is capped with a grass cover to minimize surface erosion. The landfill cover is approximately 3 to 6 feet higher in elevation than the access roadways surrounding the site. Large mounded areas remain in various locations throughout the site. Two drainage ditches border the site to the north and south and flow eastward into culverts beneath the Naval Air Station which convey surface water runoff to Willoughby Bay.

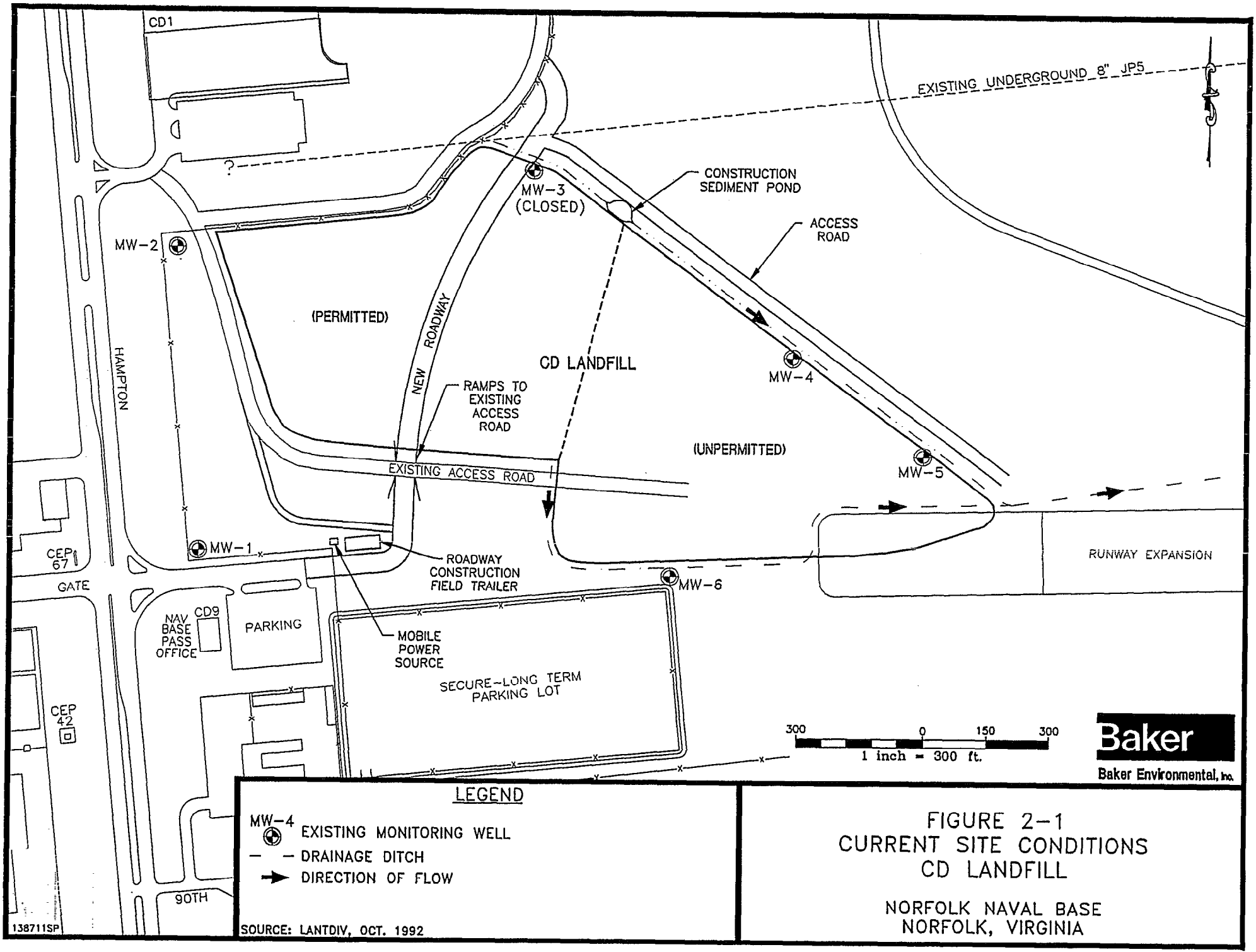


FIGURE 2-1
CURRENT SITE CONDITIONS
CD LANDFILL

NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

Environmental Science and Engineering, Inc. (ESE) conducted an Expanded Site Investigation of the CD Landfill from February 1990 to June 1991. Twelve subsurface soil samples (two samples per boring) were collected from six well borings. Groundwater monitoring wells were installed at these six boring locations. Two rounds of sediment and surface water samples were collected at five locations, as well as two rounds of groundwater samples. Figure 2-2 presents previous sampling locations.

Sediment and subsurface soil samples were analyzed for lead, iron, cadmium, pH, total organic halogens (TOX) and moisture content. The surface water and groundwater samples were analyzed for total cadmium, total organic carbon (TOC), pH, specific conductivity, lead, iron, sodium, and hardness.

Concentrations of cadmium, iron, and lead exceeding background criteria were found to be present in subsurface soils across the site, with TOX detected at moderate concentrations. These constituents also were detected in the sediment with the concentrations gradually increasing eastward. Total lead concentrations exceeded Virginia Water Control Board (VWCB) standards in four of the six groundwater samples and iron concentrations exceeded standards in all groundwater samples for both sampling events.

Total cadmium and lead were not detected in surface water. Total iron concentrations in all surface water samples exceeded VWCB standards.

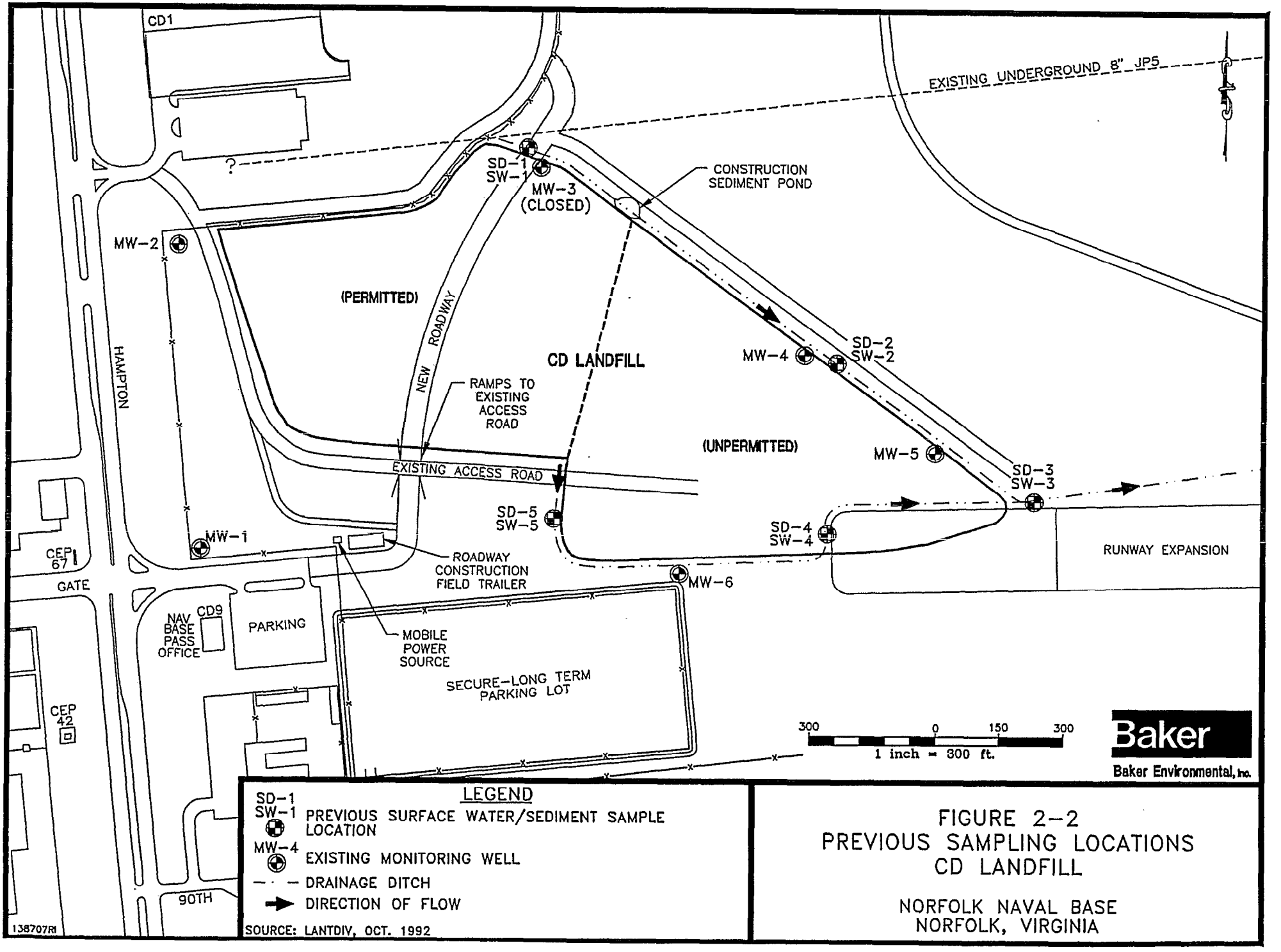


FIGURE 2-2
PREVIOUS SAMPLING LOCATIONS
CD LANDFILL

NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

3.0 TECHNICAL APPROACH

This section presents an overview of the field investigation to be conducted at the CD Landfill site with specific details of the investigation provided in the Sampling and Analysis Plan (SAP). The field investigation proposed herein is designed to meet the RI/FS objectives identified in Section 1.0 of this Work Plan.

The various media to be sampled at the CD Landfill site will be selectively analyzed for volatile organic compounds, semivolatile organic compounds, pesticides/PCBs, and inorganic compounds, including total and dissolved fractions, as required. Select aqueous samples will also be analyzed for water quality indicator parameters such as chloride, sulfate, and alkalinity. Analyses will be performed under Contract Laboratory Program (CLP) and Naval Energy and Environmental Support Activity (NEESA) protocol. In addition, NEESA Level D quality assurance will be followed. Specific detail is discussed below and in the attached SAP and QAPP documents.

3.1 Site Visit

A site visit was conducted on December 17, 1992. At that time, the Baker Project Manager (PM) and LANTDIV representative walked the site, identifying existing well locations, drainage areas, and potential sediment and surface water sampling locations. Logistical information regarding rig access to the landfill and accessibility to the drainage areas by field sampling personnel was noted during the first site visit.

A second site visit was conducted on May 18, 1993, by the Baker Project Manager and Activity representative to view progress on the new roadway being constructed through the site. Details pertaining to how the road has impacted existing site conditions have been discussed above in Section 2.0, Background and Setting.

A third site visit was conducted on June 3, 1993, by the Baker PM, LANTDIV Engineer-in-Charge and the Activity representative. At that time, locations for the site trailer, decon and drum staging areas were determined. Access to all sampling points by drill rig and sampling crews were discussed with the road construction site manager, as a portion of his crew may remain on site to complete landscaping activities during the initial portion of the field investigation.

3.2 Field Activities

3.2.1 Subcontractor Procurement

This task involves the procurement of services such as land surveying, drilling, laboratory analysis, and data validation. Procurement of these services will be performed in accordance with the Navy CLEAN Contract Procurement Manual.

3.2.2 Geophysical Investigation

Magnetic and electromagnetic surveys will be conducted to define the landfill boundary. Ground Penetrating Radar (GPR) will be used to determine if any drums or buried metal are present in areas proposed as test boring/ monitoring well locations.

The landfilled areas to be investigated via geophysical methods total approximately 40 acres. However, LANTDIV has requested the geophysical investigation be extended to include the area just north of the northeast drainage ditch to more accurately define the boundaries of the landfill. In addition, the area southwest of the permitted landfill will be investigated as part of this task. Figure 3-1 presents the proposed geophysical investigation area.

3.2.3 Landfill Soil Borings

Fifteen (15) soil borings will be advanced; seven in the permitted landfill area and eight in the vicinity of unpermitted landfill. All borings will be advanced to two feet below the base of fill material (approximately 10 to 15 feet below ground surface).

The confining clay layer separates the water table aquifer (Columbia) from the Yorktown Aquifer. Five borings will extend beyond the fill material to the confining clay layer if present (approximately 25 feet below ground surface). The "confining unit" borings have been tentatively located in the vicinity of closed well MW-3 and existing well MW-4 as clay was not encountered during the installation of these wells.

Three soil samples will be collected from each boring for a total of 45 samples. One surface soil sample will be collected from 0 to 3 inches depth and will be analyzed for Target Analyte List (TAL) metals and cyanide. This sample will be used during the Risk Assessment to determine potential risk to human health. One subsurface soil sample will be collected from the

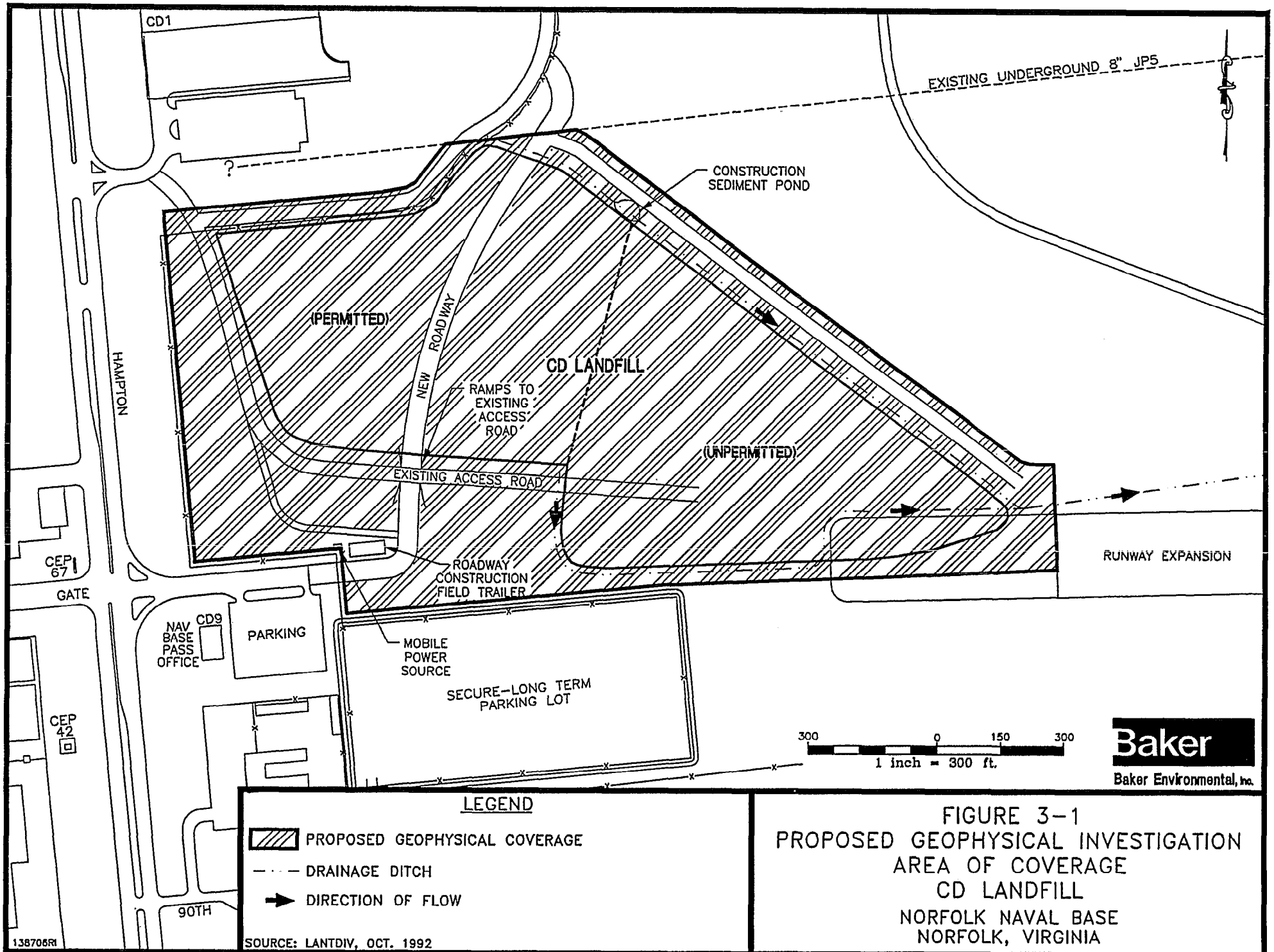


FIGURE 3-1
PROPOSED GEOPHYSICAL INVESTIGATION
AREA OF COVERAGE
CD LANDFILL
NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

soil/water interface and also will be analyzed for TAL metals and cyanide. This sample will assist in characterizing subsurface soil quality. The third sample will be collected two feet below any fill material, if encountered, and analyzed for TAL metals and cyanide. In addition, it is assumed that 10 of the 45 soil samples will be analyzed for Target Compound List (TCL) parameters in borings where visual contamination and/or elevated PID measurements are detected. Figure 3-2 presents proposed soil boring locations.

Upon completion of sampling, each soil boring will be grouted to the ground surface with a cement/bentonite mixture. The drill rig and associated sampling equipment will be steam cleaned prior to initiation of drilling activities and between boring locations. All drill cuttings and decontamination water will be containerized in 55 gallon drums and will be staged as directed by the Activity for future disposal pending receipt and evaluation of analytical results.

3.2.4 Surface Water Sampling

Surface water samples will be collected from eight locations and will be analyzed for TCL and TAL parameters (including total and dissolved metals and cyanide). In addition, samples will be analyzed for chloride, sulfate, and alkalinity. Samples will be collected from five previously sampled locations, as well as three new locations as discussed with LANTDIV on December 21, 1992 and June 29, 1993. Figure 3-3 presents proposed surface water and sediment sampling locations.

3.2.5 Sediment Sampling

Sediment samples will be collected from 14 locations (Figure 3-3) including four previously sampled locations and 10 new locations as discussed on December 21, 1992 and June 29, 1993. Samples will be collected from 0 to 3-inch depth at each location. Additionally, one sediment sample will be collected from a depth of 2 to 2.5 foot depth at six of the locations. Therefore, a total of 20 sediment samples will be submitted to the laboratory. Analytical parameters will include the TCL/TAL parameters.

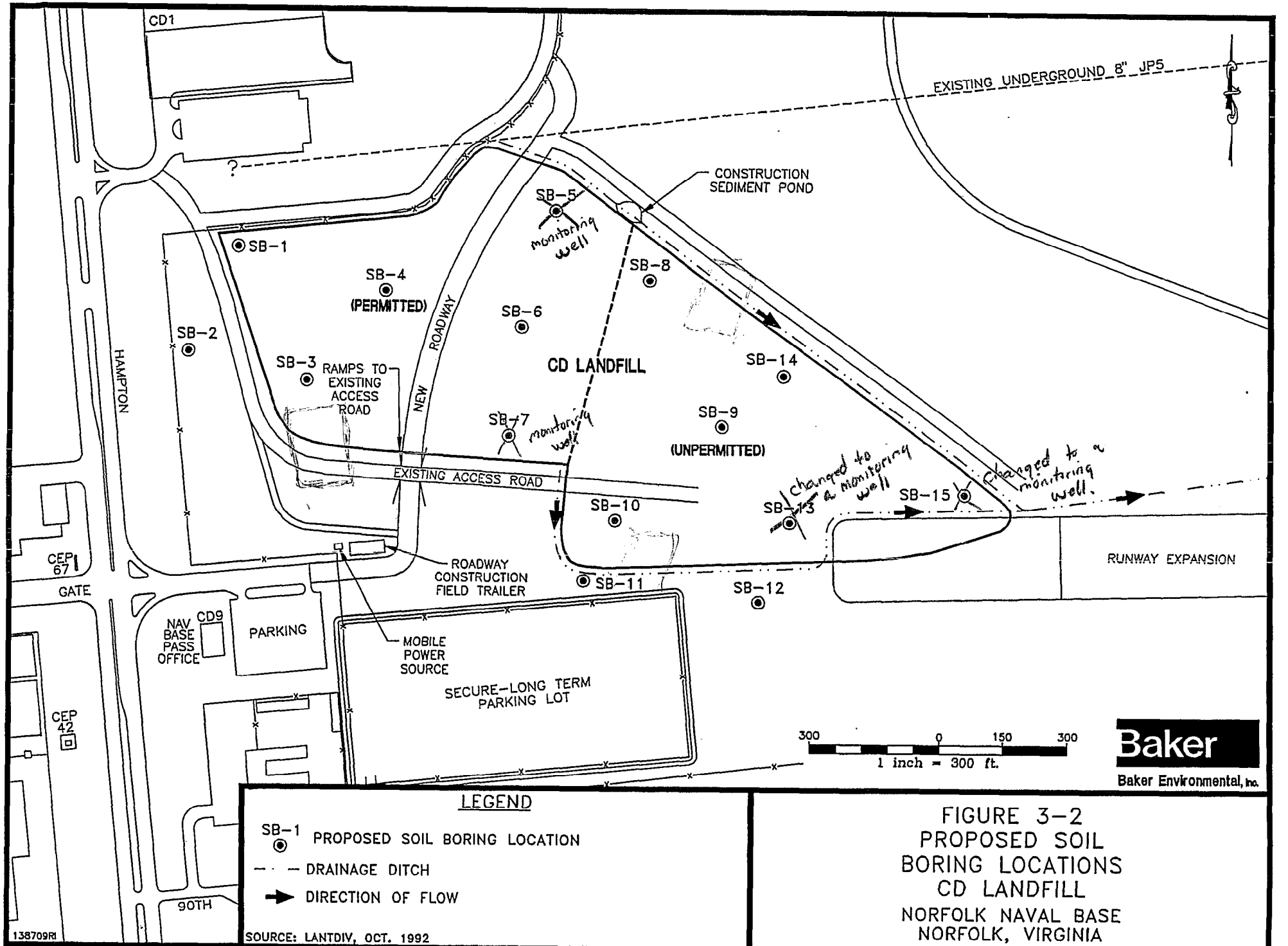


FIGURE 3-2
PROPOSED SOIL
BORING LOCATIONS
CD LANDFILL
NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

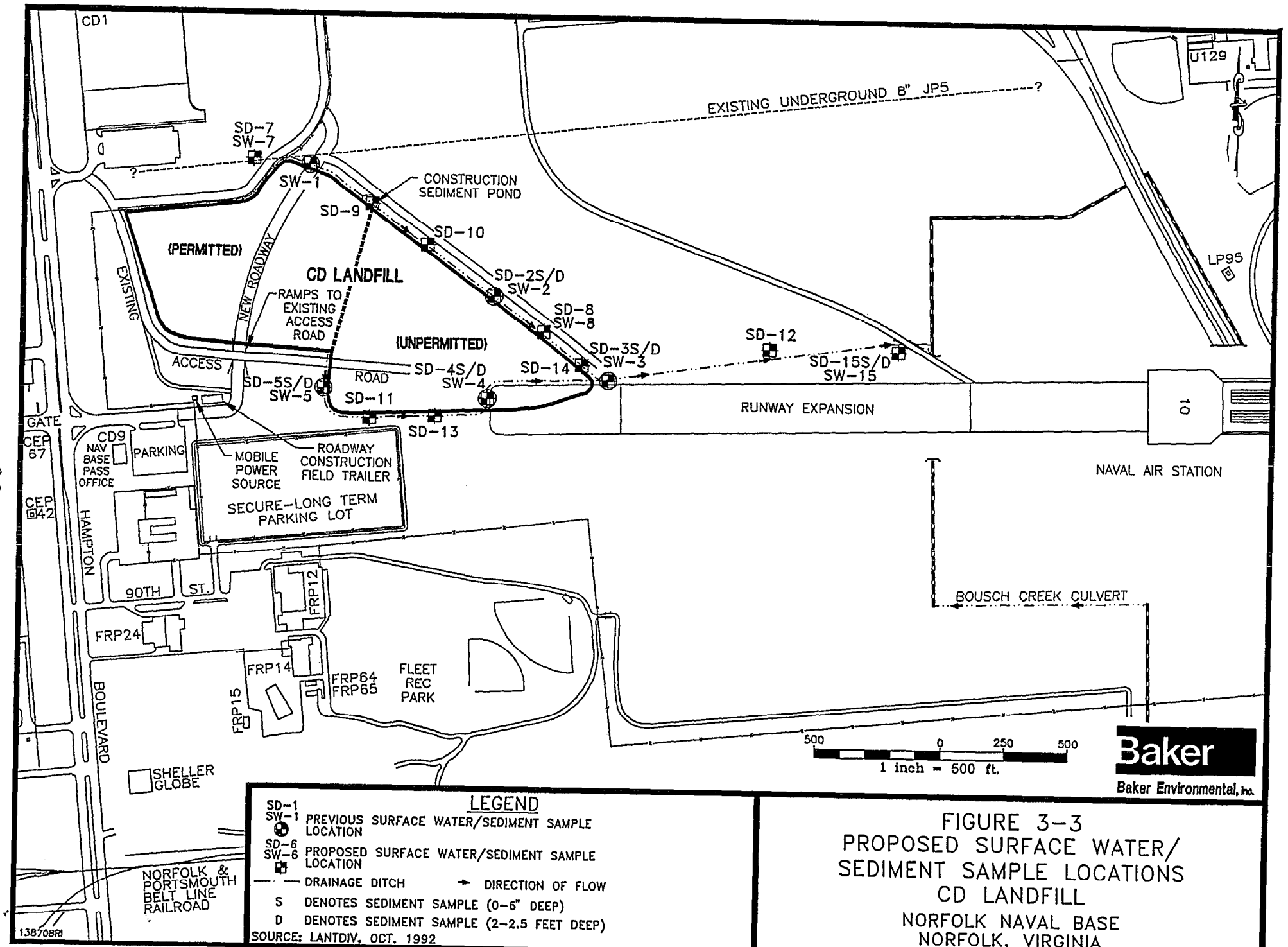


FIGURE 3-3
PROPOSED SURFACE WATER/ SEDIMENT SAMPLE LOCATIONS
CD LANDFILL
NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

3.2.6 Monitoring Well Drilling and Installation

One deep well will be installed to replace well MW-3 which was closed as part of road construction activities. This well will be screened to monitor the lower 10 feet of the Columbia Aquifer, estimated to be a depth of 25 to 30 feet below grade.

One shallow well (each approximately 15 feet deep) will be installed adjacent to replacement well MW-3, and existing wells MW-4, MW-5 and MW-6 to create a well "cluster". These wells will be screened across the soil/water interface to characterize groundwater quality in the upper Columbia Aquifer. One shallow well (MW-7) also will be installed in the southern portion of the site for a total of five shallow wells. The replacement well at MW-3 and five shallow wells will be of Type II well construction.

In addition, one deep well (approximately 65 to 85 feet deep) will be installed at MW-3 to monitor groundwater quality in the Upper Yorktown Aquifer. This well will be installed as a Type III well. Type III wells are constructed by "casing off" the upper aquifer to prevent vertical migration of contaminants from the upper into the lower aquifer.

It is anticipated that wells will be placed at landfill boundaries and not into fill material. After a review of the geophysical survey data, the monitoring wells can be more accurately located. Figure 3-4 presents proposed monitoring well locations.

It is assumed that all wells will be constructed using 2-inch diameter, Schedule 40, PVC screen and riser. Drilling will be conducted in Level C personal protective equipment until field measurements indicate conditions warrant a downgrade in the level of protection. However, Level B equipment will be kept on standby should field measurements indicate the need to upgrade the level of protection. Resultant drill cuttings and development/ decontamination water will be containerized and staged as required.

In order to address subsurface soil quality, one soil sample will be collected from each of the newly installed shallow wells at the soil/water interface. In addition, one subsurface soil sample will be collected from the upper Yorktown Aquifer well. A total of five soil samples, as well as required QA/QC samples, will be submitted for laboratory analysis for TCL and TAL constituents.

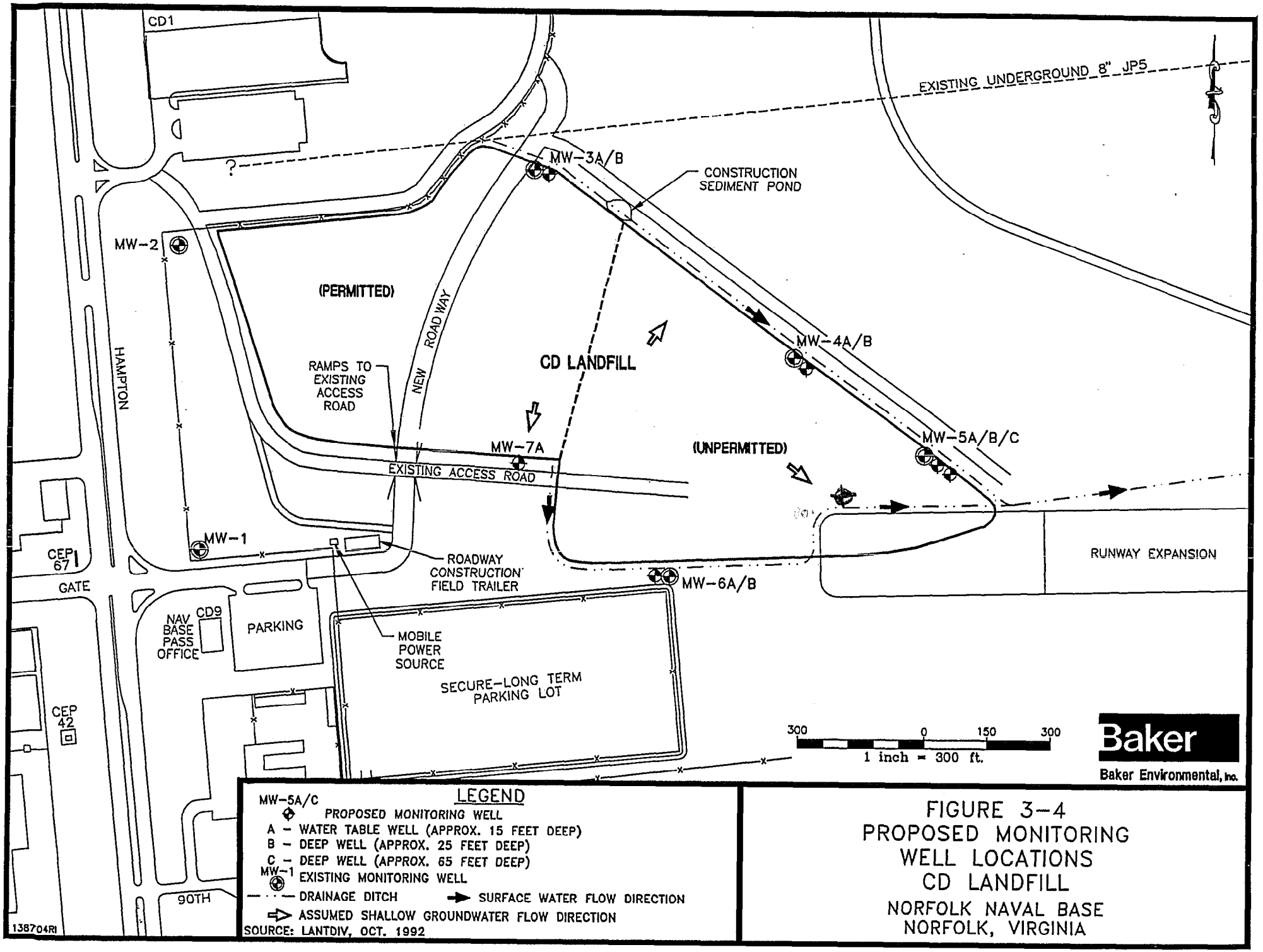


FIGURE 3-4
PROPOSED MONITORING WELL LOCATIONS
CD LANDFILL
NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

3.2.7 Groundwater Sampling Round 1

Two separate groundwater sampling events will be conducted as part of the Remedial Investigation. Sampling will occur after all wells have been installed and developed.

Development will occur a minimum of 24 hours after well installation in order to allow sufficient time for the grout (placed during well installation) to set. Groundwater sampling will be conducted not less than four days after well development so that the well has been permitted adequate time to recover.

Groundwater from five existing shallow wells (approximately 25 feet deep) and seven newly installed wells (five shallow to approximately 15 feet deep, one well to approximately 25 feet deep and one deep well to approximately 65 to 85 feet deep) will be sampled during Round 1. A total of 12 environmental groundwater samples and required QA/QC samples will be collected.

Environmental samples and appropriate QA/QC samples will be submitted to the laboratory for analysis of the TCL and TAL constituents (including total and dissolved metals and cyanide), chlorinated herbicides, asbestos, gross alpha, gross beta, chloride, sulfate, and alkalinity. Additional groundwater quality indicator parameters will include hardness, total organic carbon (TOC), and total organic halogens (TOX).

3.2.8 Groundwater Sampling Round 2

Groundwater from all 12 wells (five existing and seven newly installed wells) will be sampled no less than three months (90 days) after the first sampling event. A total of 12 environmental groundwater samples and required QA/QC samples will be collected. These samples will be analyzed for the TCL and TAL constituents (including total and dissolved metals and cyanide).

3.2.9 Water Level Measurements

Static water level will be measured in all existing wells prior to initiation of field activities and in both existing and newly installed wells during each groundwater sampling event for a total of three rounds. Measurements will be obtained from top of the steel and PVC casings to determine groundwater elevations in the water table aquifer and the Yorktown Aquifer.

3.2.10 Aquifer Testing

An in-situ hydraulic conductivity test (slug test) will be conducted on each of the five existing and seven newly installed wells. Standard variations of the rising head test or falling head tests will be conducted on each well.

In this type of test, a solid slug of known dimensions is introduced below the water table or withdrawn quickly to induce a disturbance in the water column. Monitoring wells with measurable free-product, if present, will not be considered for the well-head tests. Water level data will be collected using In-Situ Environmental Data Loggers equipped with pressure transducers. All downhole equipment will be decontaminated using the procedures as described in the SAP.

Data generated from the hydraulic conductivity tests will be analyzed using the Geraghty and Miller aquifer test solver (AQTESOLV) program. This program uses the Bouwer and Rice (1967) method (for unconfined aquifers) for analysis of data. Data obtained from the hydraulic conductivity tests will provide estimates of hydraulic conductivity, transmissivity, and storativity. Please note that slug testing of wells which may be installed in the Yorktown Aquifer will require evaluation appropriate for confined to semi-confined aquifer conditions.

3.2.11 Surveying

Selected surface features, 8 surface water sample locations, 14 sediment sample locations, 15 test boring locations, and 12 monitoring wells (7 new and 5 existing) will be surveyed for vertical and horizontal control. Permanent landmarks (i.e., fences, buildings) also will be surveyed, as appropriate.

3.2.12 Waste Handling

Drill cuttings, development water, and purge water will be containerized in 55-gallon drums and staged at a location determined by the Activity pending receipt and evaluation of analytical results. Initial drum staging and generation of a drum log to facilitate future disposal activities will also be performed. Figure 3-5 presents the proposed field support area including site trailer, rig decon, and drum storage areas.

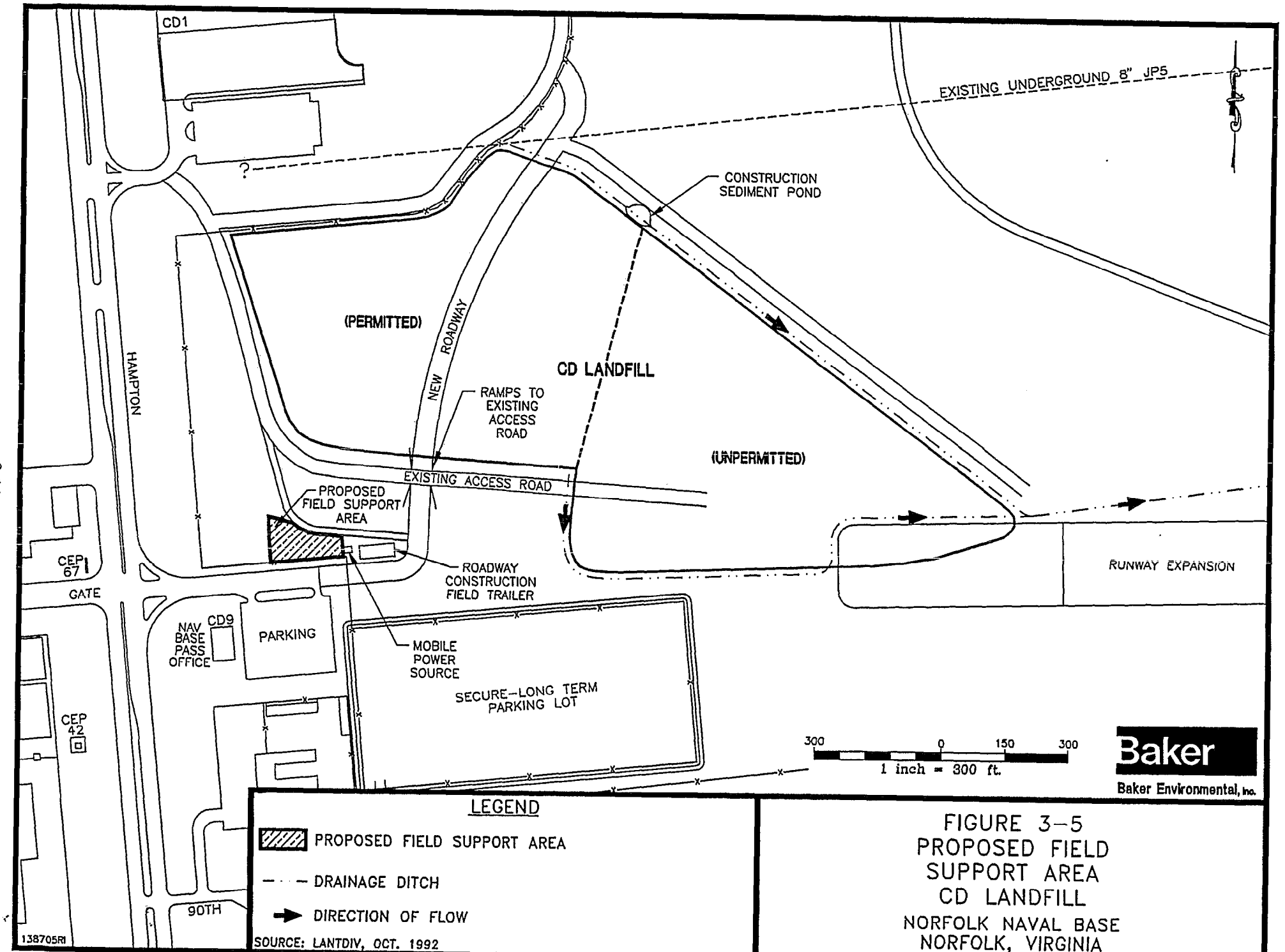


FIGURE 3-5
PROPOSED FIELD SUPPORT AREA
CD LANDFILL
NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

3.3 Sample Analysis

Samples will be analyzed according to the parameters identified above and following EPA and NEESA requirements, including Contract Laboratory Program (CLP) and SW-846 procedures. The appropriate number of field QA/QC samples, including trip blanks, field blanks, rinsate blanks, and duplicates will be analyzed in addition to laboratory QA/QC samples, including matrix spike and matrix spike duplicate samples. The SAP details QA/QC sampling requirements.

A subcontracted laboratory will be used to perform sample analysis. Baker personnel will be responsible to track analysis of the samples and obtain results from the laboratory. Two sampling events are anticipated for this project (Event 1 - Soils/Surface Water/Sediment Sampling and Groundwater Sampling Round 1; Event 2 - Groundwater Sampling Round 2) with a minimum time of 90 days between the first and second event.

Table 3-1 presents environmental and QA/QC samples for all phases of the subject investigation. The table is broken down by round, sampling media, and chemical analyses.

3.4 Data Validation

An independent data validator will perform data validation activities. Samples collected during the field investigation will be analyzed using NEESA Level D quality control. Data review procedures specified by NEESA 20.2-047B will be followed to ensure that raw data are not altered and that an audit trail is developed for those data which require reduction.

Specific QA/QC procedures for validation are presented in the QAPP. Note that 100 percent of the analytical data generated during the field investigation will be validated.

TABLE 3-1

BREAKDOWN OF ANALYTICAL SAMPLING SUMMARY
CD LANDFILL SITE

Task	No. Samples/ Estimated Depth	TCL VOCs	TCL SVOCs	TCL Pesticides/ PCBs	TAL Metals (Total)	TAL Metals (Dissolved)	TAL CN (Total)	TAL CN (Dissolved)	Chlorine Sulfate Alkalinity	Chlorinated Herbicides
Test Borings	15 / 0 to 3 inches 15 / 8 feet 15 / 15 feet	3 5 2	3 5 2	3 5 2	15 15 15	--	15 15 15	--	--	--
Sediment	14 / 0 to 3 inches 6 / 2 to 2.5 feet	14 6	14 6	14 6	14 6	--	14 6	--	--	--
Well Borings	5 / 15 feet 1 / 65 feet	5 1	5 1	5 1	5 1	--	5 1	--	--	--
Surface Water	8 / NA	8	8	8	8	8	8	8	--	--
Groundwater Round 1	12 / NA	12	12	12	12	12	12	12	12	12
Groundwater Round 2	12 / NA	12	12	12	12	12	12	12	--	--
Total Soil Samples		36	36	36	71	0	71	0	0	0
Total Water Samples		32	32	32	32	32	32	32	20	12

(1) Note that one sample will be collected at just above the soil/water interface in five shallow wells and one Yorktown Aquifer well.

TABLE 3-1 (Continued)

BREAKDOWN OF ANALYTICAL SAMPLING SUMMARY
CD LANDFILL SITE

Task	No. Samples/ Estimated Depth	TOC	TOX	Hardness	Gross Alpha	Gross Beta	Asbestos	QA/QC Samples				
								Dup.	MS/ MSD	Rinsate Blank	Trip Blank	Field Blank
Test Borings	15 / 0 to 3 inches 15 / 8 feet 15 / 15 feet	--	--	--	--	--	--	5	6	3(1)	3	Incl.(5)
Sediment	14 / 0 to 3 inches 6 / 2 to 2.5 feet	--	--	--	--	--	--	2	4	3	3(3)	Incl.
Well Borings	5 / 15 feet 1 / 65 feet	--	--	--	--	--	--	1	2	7(4)	7(4)	Incl.
Surface Water	8 / NA	--	--	--	--	--	--	1	2	NA(2)	3	Incl.
Groundwater Round 1	12 / NA	12	12	12	12	12	12	2	2	2	3(3)	2
Groundwater Round 2	12 / NA	--	--	--	--	--	--	2	2	2	3(3)	2
Total Soil Samples		0	0	0	0	0	0	8	12	13	13	0
Total Water Samples		12	12	12	12	12	12	5	6	4	9	4

(1) Assume 5 borings per day = 3 days.
(2) Assume direct fill of sample containers.
(3) Assume 1 cooler per day for 3 days of sampling for volatile organic analysis.
(4) Assume installation of one well per boring.
(5) Field blanks for test borings, sediment, well boring, and surface water samples have been included in the groundwater Round 1 sampling event.

NA = Not Applicable
TCL = Target Compound List
TAL = Target Analyte List
VOC = Volatile Organic Compounds
SVOC = Semivolatile Organic Compounds
PCBs = Polychlorinated Biphenyls
CN = Cyanide
TOC = Total Organic Carbon
TOX = Total Organic Halogen
QA/QC = Quality Assurance/Quality Control
Dup. = Duplicate
MS/MSD = Matrix Spike/Matrix Spike Duplicate

3.5 Data Assembly/Interpretation

This task involves efforts related to the analytical data management and evaluation once it is received by the laboratory and has been validated. It also involves the evaluation of any field-generated data including, test boring logs, water level measurements, in-situ permeability test results, and other field observations/documentation. Efforts under this task will include the tabulation of validated data and field data, generation of test boring logs, generation of geologic cross-section diagrams, if appropriate, and generation of other diagrams associated with investigative points or data received from the laboratory (e.g., sample location maps, isoconcentration maps).

3.6 Ecological Assessment

A qualitative ecological risk assessment will be conducted as part of the RI. One 8-hour period will be assigned for conducting field observations of plant and wildlife in the vicinity of the site. At this time, however, benthic coring of macroinvertebrates has not been included in the Scope of Work as directed by LANTDIV.

Analytical results for surface water and sediment samples will be compared to available criteria, standards, and threshold concentrations. The ecological evaluation will aid in the determination of whether potential adverse ecological effects would be experienced as a result of past disposal activities at the CD Landfill site.

3.7 Baseline Risk Assessment

A Baseline Risk Assessment will be performed for all media to assess the potential human health and environmental risks posed by the site. Appropriate Federal and state Applicable and Relevant or Appropriate Requirements (ARARs) will be identified and compared with the RI data under this task.

The risk assessment will be completed in accordance with EPA's "Risk Assessment Guidance for Superfund," dated December 1989, and EPA's "Superfund Exposure Assessment Manual," dated December 1989. The risk assessment will contain the following major components:

- A data evaluation
- Exposure scenarios

- A toxicity assessment
- Risk characterization
- An uncertainty analysis

The results of the baseline risk assessment will be documented in the RI Report.

3.8 Feasibility Study

A Feasibility Study will be performed for the CD Landfill based on results of the RI and Baseline Risk Assessment. The objective of the study is to select and describe a remedial action appropriate for mitigating any confirmed environmental contamination resulting from activities related to the CD Landfill.

Meeting this objective will require the preparation of a Feasibility Study Report, which will provide necessary data, direction and documented supportive rationale to acquire regulatory concurrence at Federal, state, and local levels with the recommended remedial alternatives. Refer to Section 4.0, Remedial Action Alternatives Development.

3.9 Remedial Investigation/Risk Assessment Report and Feasibility Study Report

This task covers the preparation of a Draft, Draft Final and Final RI/RA Report and FS Report. The content of the reports will include an introduction, environmental setting, field program, risk assessment, discussion of the results and significant findings, alternative measures, and recommendations, as appropriate.

3.10 Remedial Action Plan/Record of Decision Report

A Draft and Final Remedial Action Plan (RAP) will be prepared as part of this task. This plan will include appropriate components, as described in "Guidance on Preparing Superfund Decision Documents," EPA/540/G-89/007, July 1989.

In addition, a Draft and Final Record of Decision (ROD) Report will be prepared for the CD Landfill site following USEPA guidance as noted above. Also included in this task is the preparation of the Public Notice on the proposed RAP/ROD and a Responsiveness Summary for up to approximately 12 comments.

3.11 Community Relations Activities

Community relations services will be provided to support the studies at the CD Landfill. A variety of community relations activities have been tasked for Naval Base Norfolk under Contract Task Order 0014. These activities will include the CD Landfill and encompass a site slide presentation, site photograph album, site brochure, and provisions to organize a public meeting. The site slide presentation will provide an overview of the IR Program at the Base and will include color site photographs, CADD figures, and color text/graphics. A script will be provided. The site photograph album will also provide a summary of the IR Program at the Base and includes color photographs, CADD figures, and text descriptions for each site. The site brochure will address all active IR Program sites at the Base and will provide the public with a brief synopsis of the sites, community concerns, and the IR Program process. A base map and photographs of each site will be featured.

Activities specific to the CD Landfill include fact sheet development and Community Relations Plan (CRP) addendums. A general fact sheet may be developed for the CD Landfill with the approval of LANTDIV and NAVBASE. This fact sheet will provide a brief history of disposal activities, include a site figure and reference the current information repositories and official Navy points-of-contact. The printing of this fact sheet (if used) will be covered under CTO-0014, modification pending. Other fact sheets may be developed for local distribution as efforts progress. The nature of these fact sheets may include notification of nearby communities of field operations or a synopsis of investigation results. These fact sheets will be printed on a laser printer and photocopied.

The Naval Base Norfolk CRP includes IR Program site descriptions and recommended community relations activities designed to keep the local community informed of the IR Program. As the studies at the CD Landfill progress, addendums to the CRP may be issued. At the conclusion of the RI, a revised description of the CD Landfill and progress to date will be issued as an addendum to the CRP will be provided to the information repositories.

Throughout the CD Landfill RI/FS, close coordination of activities will be maintained by Baker, LANTDIV, and the Public Affairs Office, Naval Base Norfolk to provide proactive communication with the community.

3.12 Meetings

The BAKER Project Manager and Project Geologist shall attend an initial meeting/site visit, two advisory panel meetings, one community meeting and one TRC meeting as part of this CTO. It is anticipated that both the Risk Assessment Specialist and Feasibility Study engineer will attend the community meeting, TRC meeting and at least one of the two advisory meetings.

4.0 REMEDIAL ACTION ALTERNATIVES DEVELOPMENT

Consistent with the National Contingency Plan (NCP) and in accordance with SARA, the Feasibility Study (FS) will utilize the findings of the Remedial Investigation to develop and evaluate alternative remedial measures for the CD Landfill Site. The major tasks associated with conducting an FS, which are outlined below include: (1) Development and Screening of Remedial Action Alternatives, (2) Detailed Analysis of Remedial Alternatives, and (3) Feasibility Study Report.

4.1 Development and Screening of Remedial Action Alternatives

The overall objective of this task is to develop a set of remedial action alternatives that address contamination at a site. The set of alternatives will then undergo a detailed analysis. This task begins when there is sufficient data available to initiate the identification of potential remedial action technologies, and when target cleanup levels for the site remediation can be concluded from the risk assessment. This task involves six general steps: (1) the development of remedial action objectives; (2) development of general response actions for each medium of interest; (3) identification of volumes or areas of media which general response actions might be applied; (4) identification and screening of technologies applicable to each general response action; (5) identification and evaluation of technology process options to select a representative process for each technology type retained for consideration; and (6) assemble selected technologies into alternatives representing a range of treatment and containment combinations. As required by the NCP, a no action alternative will be carried through the entire FS process.

Treatment may range from alternatives that, to the degree possible, would eliminate the need for long-term management (including monitoring) at the site, to alternatives that would primarily reduce toxicity, mobility, or volume. Containment methodologies may range from excavation and off-site disposal of contaminated media to in situ isolation of waste materials via installation of physical barriers.

In order to reduce the number of alternatives evaluated in the detailed analysis, the set of potential technologies or methods will be subject to a preliminary screening to identify and distinguish differences among various alternatives and to evaluate each alternative with respect to its effectiveness, implementability, and cost. Individual remedial technologies will be researched through available literature from similar remedial investigations, feasibility

studies, and remedial action projects. Technologies which have proved cost-effective and implementable on other similar projects, or those that have been demonstrated or appear to be reliable, will be retained for the detailed evaluation. Technologies determined to be too costly or too difficult to implement, and/or will not achieve the remediation goals within a reasonable time period, will be eliminated from further consideration. Only the alternatives judged as the best or the most promising on the basis of these evaluation factors will be retained for further consideration and analysis. For reporting and tracking purposes, this task is defined as complete when a final set of alternatives is chosen for detailed evaluation.

4.2 Detailed Analysis of Remedial Alternatives

This task includes the detailed analysis of the remedial action alternatives brought through the screening discussed previously. The objective of this task is to provide sufficient information to compare alternatives and select an appropriate alternative for a site. This task involves the evaluation of the potential alternatives with respect to the nine criteria listed below:

- Threshold Criteria: Overall protection of human health and the environment; compliance with ARARs
- Primary Balancing Criteria: Long-term effectiveness and permanence; reduction of toxicity, mobility, and volume; short-term effectiveness; implementability; cost
- Modifying Criteria: State acceptance; Community acceptance

The results of this assessment will be used to compare the alternatives and identify the key tradeoffs among them. Therefore, this evaluation will provide the basis for identifying a preferred alternative and preparing the proposed plan.

4.3 Feasibility Study Report

This task involves reporting the findings of the Feasibility Study. The task covers the preparation of a Draft, Draft Final and Final FS report. The FS report will include a summary of the screenings and evaluations conducted on the technologies and alternatives. The table of contents of the FS report may include but will not be limited to the following sections:

- Introduction (including purpose of the report and site background)

- Identification and Preliminary Screening of Technologies (including remedial action objectives, general response actions, identification of technologies, screening of technologies and process options)

- Development of Remedial Action Alternatives

- Detailed Analysis of Alternatives (including individual and comparative analysis)

- Summary of Detailed Analysis

- References and Appendices

The FS report will be prepared for the CD Landfill site based on RI/RA findings

5.0 PROJECT MANAGEMENT AND STAFFING

Project management activities involve such activities as daily technical support and guidance, budget and schedule review and tracking, preparation and review of invoices, personnel resources planning and allocation, and communication with the LANTDIV EIC, the Activity Environmental Coordinator, and subcontractors.

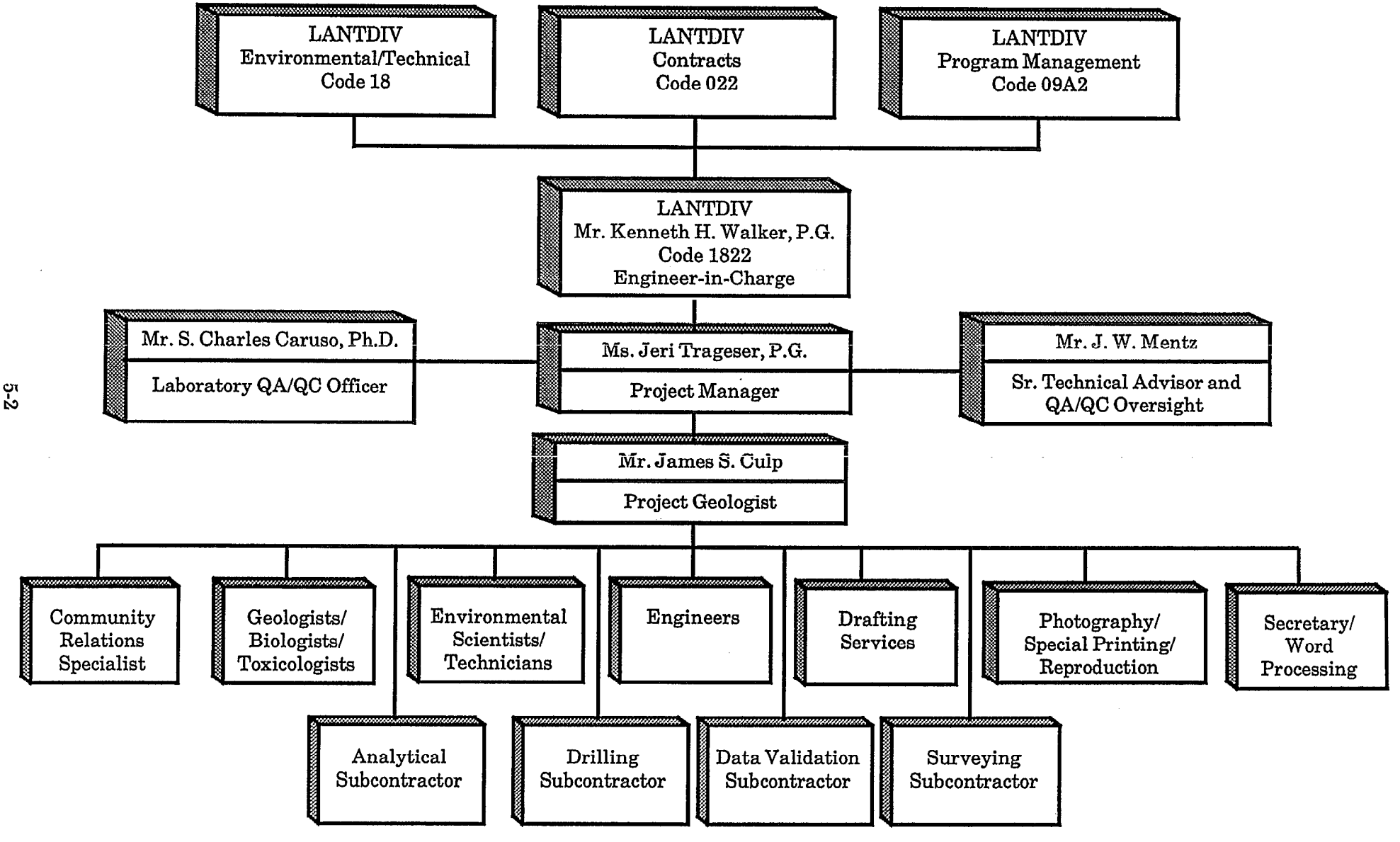
The proposed management and staffing of this RI/FS is depicted in Figure 5-1. The primary participants for this project include:

- Ms. Jeri L. Trageser, P.G., Project Manager
- Mr. John W. Mentz, Senior Technical Advisor and QA/QC Oversight
- Mr. James S. Culp, Project Geologist
- Mr. Michael Smith, Environmental Sampler
- Ms. Barbara J. Cummings, Site Health and Safety Officer/Environmental Sampler
- Mr. Richard F. Hoff, Risk Assessment Specialist
- Mr. Richard P. Aschenbrenner, Feasibility Study Engineer
- Dr. Charles Caruso, Laboratory Coordinator

The Baker Project Manager will have as primary responsibilities: (1) monitoring technical, cost and schedule performance; (2) orchestrating Bakers overall QA efforts -- audit, document reviews, cost/schedule reviews -- with the Program Manager, audit, and senior technical staff; and (3) maintaining close communication with the LANTDIV EIC and the Activity project officer.

Project Management responsibility will be delegated to Ms. Jeri Trageser. Mr. James Culp, Mr. Michael Smith, and Ms. Barbara Cummings will be responsible for conducting field activities. Mr. Richard Hoff will be responsible for development of the Baseline Risk Assessment. Mr. Richard P. Aschenbrenner will be responsible for development of the Feasibility Study. They will be supported by geologists, engineers, biologists, chemists, data technicians, and clerical personnel, as required.

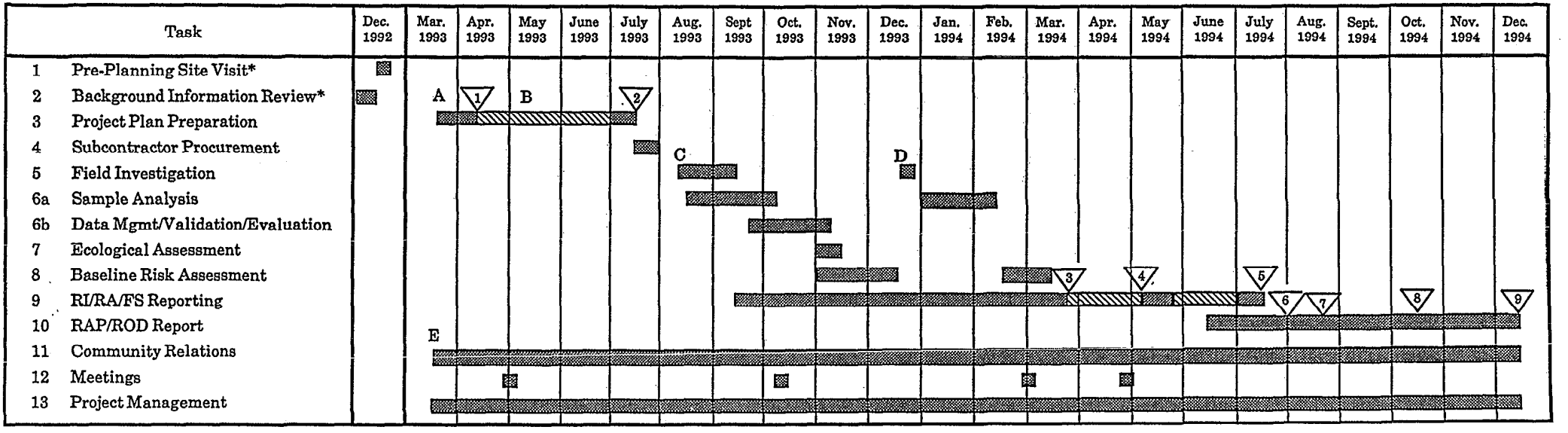
FIGURE 5-1
PROJECT ORGANIZATION
CTO-0138



6.0 SCHEDULE

This project will be performed in accordance with the schedules and milestones presented on Figure 6-1. Figure 6-2 presents a breakdown of field activities during each work period. Potentially required schedule modifications will be discussed with LANTDIV and documented accordingly.

FIGURE 6-1
ESTIMATED PROJECT SCHEDULE
CTO-0138, CD LANDFILL RI/FS
NORFOLK NAVAL BASE, NORFOLK, VIRGINIA



*Tasks 1 and 2 have been completed under PMO

A-Start date effective March 16, 1993.

B - ▨ denotes Government Review period

C - Round 1

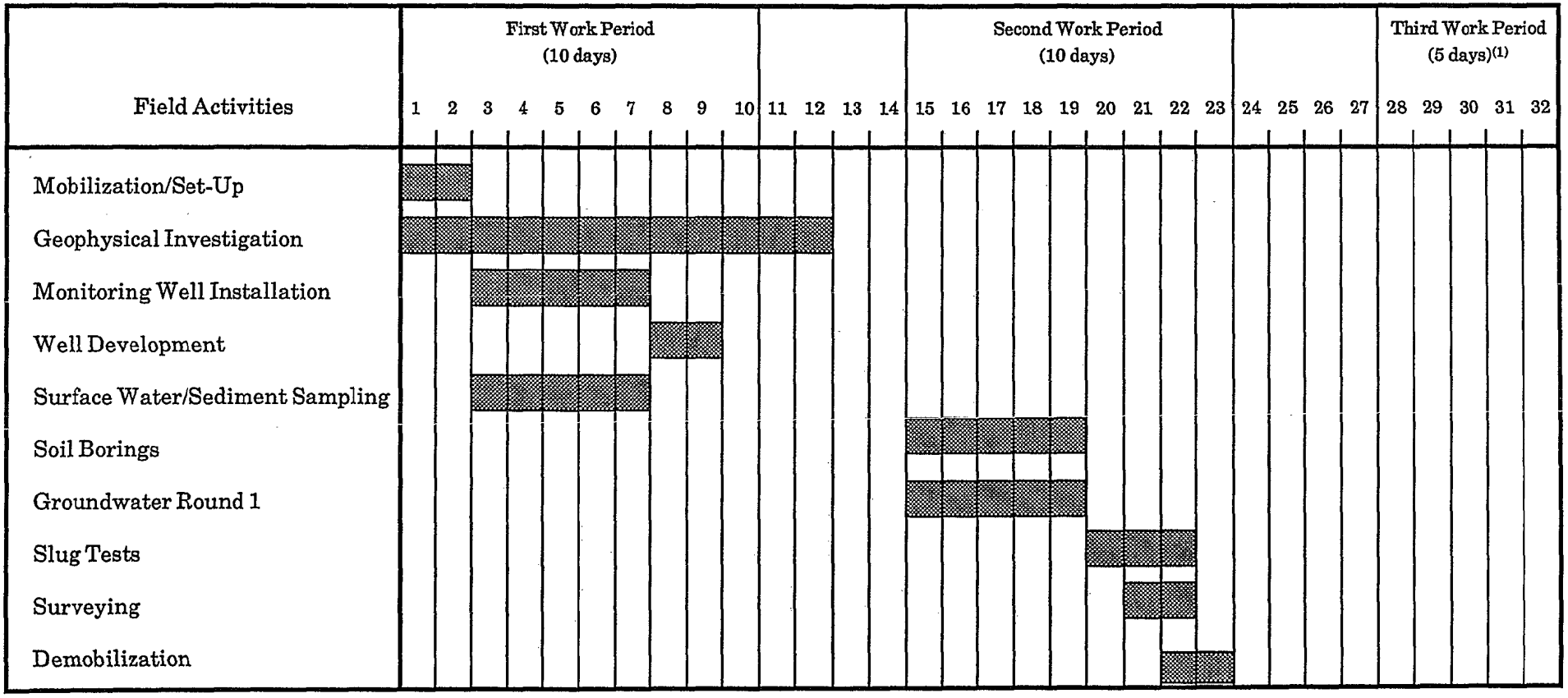
D - Round 2

E-Community Relations ongoing throughout duration of project under CTO-0014

1. Draft Project Plans (4-15-93)
2. Final Project Plans (7-13-93)
3. Draft RI/RA/FS Reports (3-21-94)
4. Draft Final RI/RA/FS Reports (5-23-94)
5. Final RI/RA/FS Reports (7-11-94)
6. Draft RAP & ROD (8-1-94)
7. Public Notice (8-17-94)
8. Responsiveness Summary (10-19-94)
9. Final RAP & ROD (12-14-94)

FIGURE 6-2

BREAKDOWN OF FIELD ACTIVITIES
CD LANDFILL SITE
NAVAL BASE, NORFOLK, VIRGINIA



(1) The last work period of 5 days will be used if extra time is necessary to complete the field activities as scoped.

7.0 REFERENCES

Barnett, Cheryl F., 1987. Assessing Navy Efforts at an Installation Restoration Site, the CD Landfill.

Environmental Science and Engineering (ESE), 1991. Draft Expanded Site Investigation Report, CD Landfill, NAS, Norfolk, Virginia.

United States Environmental Protection Agency, 1988. Methods for the Determination of Organic Compounds in Drinking Water. EPA-600/4-88/039.

United States Environmental Protection Agency, 1989. Risk Assessment Guidelines for Superfund.

United States Environmental Protection Agency, 1989. Superfund Exposure Assessment Manual.

United States Environmental Protection Agency, 1991. Guidance for Conducting Remedial Investigations/Feasibility Studies Under CERCLA. Office of Emergency and Remedial Response, OSWER Directive 9345.0-01A, September, 1991.

United States Navy, 1987. Draft Confirmation Study Report, Sewell's Point Naval Complex, Norfolk, Virginia, CD Landfill (Site 6).

United States Navy/Marine Corps , 1991. Installation Restoration Manual. February, 1992.

FINAL

ATTACHMENT A

HEALTH AND SAFETY PLAN

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY

CD LANDFILL
NAVAL BASE, NORFOLK, VIRGINIA

CONTRACT TASK ORDER 0138

Prepared For:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under the:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared By:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

JULY 13, 1993

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

EXECUTIVE SUMMARY

The chemical hazards associated with the tasks at this site are expected to include exposure to varying levels of inorganic metals in soils, sediments, groundwater and surface water. There is also some concern for the potential for exposure to pesticides and volatile/semivolatile constituents, even though the disposal of these types of materials was not approved for this landfill. There is, however, documentation of the disposal of construction debris that may have included asbestos-containing building materials.

The physical hazards include working around heavy equipment, underground/overhead utilities, uneven/sloped terrain, vehicular traffic, and heat stress. The environmental hazards include potentially hazardous flora and fauna. Each of these hazards is described in Section 3.0.

Section 5.0 describes the environmental monitoring requirements which consist of using a PID, Oxygen/Combustible Gas Meter, and Radiation Survey Meter.

Due to the limited amount of information provided by previous investigations and record searches, assigned protection levels at this site are conservative in nature. The level of personal protection equipment (PPE) used for work tasks and other operations will be Levels D through C (in the "unpermitted" section of the landfill, Level B will remain on standby), with protection upgrades/downgrades dependent on monitoring results and the Site Health and Safety Officer's discretion.

Section 8.0 describes emergency procedures which includes Figure 3, showing the route to the nearest public hospital; along with first aid procedures, communication procedures, and other site concerns.

1.0 INTRODUCTION

1.1 Policy

It is the policy of Baker Environmental, Inc. (Baker) that all on-site hazardous waste management activities be performed in conformance with a Site-Specific Health and Safety Plan (HASP). The HASP is written based on the anticipated hazards and expected work conditions and applies to activities performed by both Baker and subcontractor personnel. The HASP may be modified/updated with the approval of the Project Health and Safety Officer (PHSO) and Project Manager. Proper notification will be given to the Navy Engineer-in-Charge (EIC) when significant changes to the plan are implemented.

The HASP is based on an outline developed by the U.S. Coast Guard for responding to hazardous chemical releases (U.S.C.G. Pollution Response COMDTINST-ML6456-30) and by NIOSH, OSHA, USCG, and EPA's recommended health and safety procedures (Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities). This plan, at a minimum, meets the requirements under OSHA Standard 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response). This plan has been designed as a Site-Specific HASP for the Remedial Investigation/Feasibility Study, Remedial Action Plan, and Record of Decision for the CD Landfill (Site 6), Naval Base, Norfolk, Virginia.

1.2 References

The following publications have been referenced in the development and implementation of this HASP.

- American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 1992-1993.

- The Center for Labor Education and Research, Lori P. Andrews, P.E., Editor. Worker Protection During Hazardous Waste Remediation, Van Nostrand Reinhold, New York, New York. 1990.

- Lewis, Richard J., Sr. Hazardous Chemicals Desk Reference, 3rd Edition, Van Nostrand Reinhold, New York, New York. 1991.

- National Institute for Occupational Safety and Health/Occupational Safety and Health Administration/U.S. Coast Guard/U.S. Environmental Protection Agency (NIOSH/OSHA/USCG/EPA). Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. October 1985.

- U.S. Coast Guard. Policy for Response to Hazardous Chemical Releases. USCG Pollution Response COMDTINST-M16465.30.

- U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, NIOSH. NIOSH Pocket Guide to Chemical Hazards. June 1990.

- U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Emergency Response Division. Standard Operating Safety Guides. July 1988.

1.3 Pre-Entry Requirements

During the initiation of site activities (site mobilization) and prior to the investigation, the SHSO will perform a reconnaissance of the anticipated work areas as identified in the Work Plan, confirm emergency points of contact and procedures, and review any other issues deemed necessary to address site safety and health. The SHSO will then call a meeting with site personnel (as identified in Section 2.0) to discuss data obtained from the previous site reconnaissance, provisions outlined in this HASP, and appropriate safety and health related procedures/protocols.

2.0 PROJECT PERSONNEL AND RESPONSIBILITIES

The following personnel are designated to carry out the stated job functions for both on- and off-site activities. (Note: One person may carry out more than one job function, and personnel identified are subject to change.). The responsibilities that correspond with each job function are outlined below.

PROJECT MANAGER: Jeri Trageser

The project manager is responsible for assuring that all activities are conducted in accordance with the HASP. The Project Manager has the authority to suspend field activities if employees are in danger of injury or exposure to harmful agents. In addition, the Project Manager is responsible for:

- Assisting the Project Health and Safety Officer in Site-Specific HASP development for all phases of the project.
- Designating a Site Health and Safety Officer and other site personnel who will assure compliance with the HASP.
- Reviewing and approving the information presented in this HASP.

PROJECT HEALTH AND SAFETY OFFICER (PHSO): Barbara Cummings

The Project Health and Safety Officer is responsible for general development of the HASP and will be the primary contact for inquiries as to the contents of the HASP. The PHSO will be consulted before changes to the HASP can be approved or implemented. The PHSO will also:

- Develop new protocols or modify the HASP as appropriate and issue amendments to the HASP.
- Resolve issues that arise in the field with respect to interpretation or implementation of the HASP.
- Monitor the field program through a regular review of field health and safety records, on-site activity audits, or a combination of both.

- Determine that all on-site Baker personnel have received the required training and medical surveillance prior to entry onto the site.

- Coordinate the review, evaluation, and approval of the HASP.

SITE MANAGER: James Culp

The Site Manager is responsible for assuring that all day-to-day activities are conducted in accordance with the HASP. The Site Manager has the immediate authority to suspend field activities if employees are subjected to a situation that can be immediately dangerous to life or health. The Site Manager's responsibilities include:

- Assuring that the appropriate health and safety equipment and PPE has arrived on site and that it is properly maintained.

- Coordinating overall site access and security measures, including documenting all personnel arriving/departing the site (by name, company and time).

- Controlling visitor access to hazardous areas.

- Approving all on site activities.

- Coordinating site safety and health issues with the SHSO.

- Assisting the SHSO in coordinating emergency procedures with the Naval Activity, emergency medical responders, etc., during site mobilization activities.

- Assuring compliance with site sanitation procedures and site precautions.

- Coordinating activities with Baker and subcontractor personnel.

- Overseeing the decontamination of field sampling equipment.

- Assuming the responsibilities as indicated under Field Team Leader in his/her absence.

SITE HEALTH AND SAFETY OFFICER: Barbara Cummings

The SHSO is responsible for the implementation of the HASP. The SHSO also has the immediate authority to suspend field activities if the health or safety of site personnel is endangered, audit the subcontractor training, fit testing, and medical surveillance records to verify compliance, and maintaining these records at the Baker Command Post. The SHSO will also:

- Coordinate the pre-entry briefing and periodic (weekly) briefings.
- Assure that monitoring equipment is properly calibrated and properly used.
- Manage health and safety equipment, including instruments, respirators, PPE, etc., that is used in field activities.
- Confirm emergency response provisions (as necessary) in cooperation with Naval Activity Requirements, emergency medical care, etc., during site mobilization activities.
- Monitor conditions during field activities to assure compliance with the HASP and evaluate if more stringent procedures or a higher level of PPE should be implemented, and informing the PHSO and Project Manager.
- Document, as necessary, pertinent information such as accident investigation and reporting, safety inspections, a record of site conditions, personnel involved in field activities, and any other relevant health and safety issues.
- Oversee the decontamination of personnel and determine safe boundary procedures for activities requiring Level C or higher protection levels.
- Act as the Emergency Coordinator.
- Assure compliance with the Standard Operating Procedures (SOPs) in Attachment A.

FIELD TEAM LEADER: Not Applicable

The Field Team Leader is responsible for:

- Safety issues relevant to the tasks under his/her direction.
- Determining safe boundary procedures for activities requiring Level D or D+ protection levels.
- Assuring that PPE is properly maintained.
- Complying with the conditions as outlined under Field Team Members.

FIELD TEAM MEMBER: Michael Smith

The Field Team Member is responsible for:

- Familiarity with the HASP.
- Attending training sessions to review the HASP, and staying informed of additional safety and health information.
- Being alert to identified and unidentified hazards.
- Reporting unidentified hazards to the SHSO and Site Manager.
- Offering suggestions, ideas, or recommendations that may improve or enhance site safety.
- Complying with the contents of the HASP.
- Conducting site activities in an orderly and appropriate manner.
- Reporting accidents/injuries, however minor, to the SHSO as soon as possible.

Subcontractor personnel are responsible for:

- Complying with the conditions as outlined under Field Team Members.

- Obtaining the appropriate training, fit testing, and medical surveillance requirements under 29 CFR 1910.120 and 1910.134 and providing this documentation to the Site Manager during site mobilization.

- Complying with the training and medical surveillance requirements as outlined in Sections 9.0 and 10.0, respectively, and providing his/her own PPE that meets or exceeds the level of protection as outlined in this HASP.

SUBCONTRACTOR COMPANIES:

Drilling Operations:	Hardin-Huber
Survey Operations:	Hoggard-Eure
Geophysical Operations:	Weston Geophysical
Analytical Laboratory:	Wadsworth/ALERT Lab

NAVFACENGCOM REPRESENTATIVES:

Mr. Ken Walker, EIC	(804) 322-4783

ACTIVITY/BASE REPRESENTATIVES:

Ms. Sharon Waligora, Environmental Coordinator	(804) 444-3009
Mr. Dave Forsythe, Environmental Coordinator	(804) 444-3009
Mr. William Whitmire, Hazardous Waste Dispatcher	(804) 444-7528
Ms. Merrill Ashcraft, Navy On-Scene Coordinator	(804) 445-8851

FEDERAL/STATE/LOCAL REPRESENTATIVES:

(Not Applicable)

3.0 SITE CHARACTERIZATION

3.1 Site Background

Previous investigations of hazardous waste sites at the Naval Base, Norfolk, Virginia have been conducted under an Initial Assessment Study, Confirmation Study, and Expanded Site Investigation of the Installation Restoration (IR) Program, as outlined below.

In April 1982, an Initial Assessment Study (IAS) was conducted at the Sewell's Point Naval Complex, Norfolk Naval Base, Norfolk, Virginia. The IAS identified 18 sites of concern with regard to potential contamination. The CD Landfill (Site 6) was included as a potential area of concern.

A Confirmation Study was conducted by the Navy of the CD Landfill Site in 1987. Surface water and sediment were sampled quarterly and then semi-annually from 1983 to 1985.

An Expanded Site Investigation of the CD Landfill site was conducted by Environmental Science and Engineering, Inc. (ESE) from February 1990 to June 1991. Twelve subsurface soil samples (two samples per boring) were collected from six well borings. Two rounds of sediment and surface water samples were collected at five locations, as well as two rounds of groundwater samples.

The current study at the CD Landfill is intended to characterize environmental impacts resulting from past disposal activities at both the unpermitted and permitted sections of the site.

The objectives of the project are to:

- Determine the nature and extent of contamination.
- Identify possible migration pathways and resulting impacts on environmental and human populations.
- Assess risk to human health and the environment.
- Obtain data for the development of remedial action alternatives.
- Evaluate the alternatives in terms of health, welfare, and environmental impact.

3.2 Site Work Plans

The Work Plan (detailing the tasks to be performed at each site), the Sampling and Analysis Plan (SAP), and Quality Assurance Project Plan (QAPP) are bound as other sections of this document, and accompany the Health and Safety Plan.

3.3 Site Description

S.O.# 19138-SRN

Location: Norfolk, Virginia

Start-Up Date: August 9, 1993

Investigation Duration: Estimated at five weeks

Surrounding population and topography:

The area known as the CD Landfill (Site 6) is located approximately one-half mile south of Admiral Taussig Boulevard and between the Naval Air Station and Hampton Boulevard, Naval Base, Norfolk. The site incorporates two areas of landfilling operations; the eastern most section in operation from 1974 to 1979 and the western section in operation from 1979 to 1987. The Navy purchased the land in 1974 from the Western Railway Company. In 1979, a portion of the southeast corner of the unpermitted section was removed and regraded to allow for runway expansion at the adjacent Naval Air Station. Approximately 40 acres are included in this investigation.

At present, the majority of the site is capped with a grass cover to minimize surface erosion. The landfill elevation is approximately 3 to 6 feet higher in elevation than the access roadways surrounding the site. Large mounded areas remain in various locations throughout the site. Two drainage ditches, which are surrounded by dense vegetation, border the site to the north and south and flow eastward into culverts beneath the Naval Air Station which convey surface water runoff to Willoughby Bay.

Results of previous sampling:

The Initial Assessment Study report, completed in February 1983, documented the on-site disposal of approximately 1,500 cubic yards of cadmium dust contained in drums. The grit was landfilled until 1981 when it was tested and found to exceed EP toxicity limits for cadmium. Quarterly sampling of surface water and sediment was recommended.

A Confirmation Study was conducted by the Navy of the CD Landfill Site in 1987. Surface water and sediment were sampled quarterly and then semi-annually from 1983 to 1985.

Analysis of cadmium in surface waters indicated only slight contamination. Concentrations in the sediment samples ranged from less than 1 to 115 µg/g (ppm). The sediment was classified as heavily-polluted based on a comparison to general guidelines for soil contamination. EP toxicity testing of the sediment confirmed that the cadmium is not readily leachable.

Two potential sources of cadmium in the sediment were identified: erosion from the landfill surface or chemical precipitation, as the shallow groundwater flows through the site into the adjacent surface waters.

Environmental Science and Engineering, Inc. (ESE) conducted an Expanded Site Investigation of the CD Landfill site from February 1990 to June 1991. Reportedly, 8,500 tons of ash from both the power plant and the Salvage fuel boiler plant and spent blasting grit (90 tons of ricehulls) from the Naval Aviation Depot. Twelve subsurface soil samples (two samples per boring) were collected from six well borings. Two rounds of sediment and surface water samples were collected at five locations, as well as two rounds of groundwater samples.

High concentrations of cadmium, iron, and lead were found to be present in subsurface soils across the site, with TOX detected at moderate concentrations. These contaminants also were detected in the sediment with the concentrations gradually increasing eastward. Lead concentrations exceeded Virginia Water Control Board (VWCB) standards in four of the six wells and iron concentrations exceeded standards in all groundwater samples for both sampling events. Cadmium and lead were not detected in

surface water; however, pollutants appear to migrate off site through this media. Iron concentrations exceeded VWCB standards.

3.4 Hazard Evaluation

3.4.1 Task-Specific Hazards

The pre-entry briefing and daily or weekly safety meetings will serve to address the hazards particular to the site (such as slippery ground, uneven terrain, etc.) that were not apparent/known when the HASP was written. As each of these hazards are identified, the SHSO will then add to the HASP in the field along with the date of the modification.

Listed below are summaries for the known or assumed hazards associated with each of the site tasks. Levels of protection were selected based on this task-specific hazard identification, information obtained from previous investigations/site visits, and previous experience with similar site investigations/activities. Additionally, site personnel are expected to follow "safe" work practices as described in this HASP.

Task 1 - Geophysical Investigation

Chemical

- Skin contact with potentially contaminated soils.
- Ingestion of contaminated material from hand to mouth contact.

Physical/Environmental

- Slips/trips/falls - sloped, uneven terrain; crawling over and under obstacles.
- Skin irritation from contact with insects and vegetation.
- Interaction with native and potentially hostile animal life.
- Vehicular traffic.
- Explosion from introducing a flame or spark near a methane vent.

Task 2 - Sediment/Surface Water Sampling

Chemical

- Potential for contaminated material to be splashed onto body or in eyes.
- Ingestion of contaminated material from hand to mouth contact.
- Inhalation of potential volatile constituents within the sediments or surface water.
- Absorption of constituents through the skin.

Physical/Environmental

- Slips/trips/falls - sloped uneven terrain and vines; crawling over and under obstacles.
- Skin irritation from contact with insects and vegetation.
- Interaction with native and potentially hostile animal life.
- Vehicular traffic.

Task 3 - Soil Boring-Sampling

Chemical

- Potentially-contaminated mud, etc., in eyes or on skin.
- Skin contact with potentially contaminated soil.
- Ingestion of contaminated soils from hand to mouth contact.
- Inhalation of potential volatile contaminants or volatile fraction of potential semivolatile contaminants.

Physical/Environmental

- Elevated noise levels from heavy equipment operations.
- Lifting hazards (muscle strain).
- Skin irritation from contact with insects and vegetation.
- Contact with underground utilities.
- Interaction with native and potentially hostile animal life.
- Heavy objects landing on foot/toe or head.
- Strips/trips/falls from sloped, uneven terrain.
- Vehicular traffic.
- Explosion from introducing a flame or spark near a methane vent.

Task 4 - Monitoring Well Installation

Chemical

- Potentially-contaminated mud, etc. in eyes and on skin.
- Contact with potentially contaminated material.
- Ingestion of hazardous materials from hand to mouth contact.
- Inhalation of potential volatile contaminants or volatile fraction of potential semivolatile contaminants.

Physical/Environmental

- Heavy objects landing on foot/toe or head.
- Elevated noise levels from heavy equipment operation.
- Slips/trips/falls - sloped, uneven terrain; crawling over and under obstacles.
- Skin irritation from contact with insects and vegetation.
- Overhead hazards from drill rig operations.
- Interaction with native and potentially hostile animal life.
- Contact with underground utility lines.
- Lifting hazards (muscle strain).
- Vehicular traffic.
- Explosion from introducing a flame or spark near a methane vent.

Task 5 - Monitoring Well Development

Chemical

- Potentially-contaminated water, etc., in eyes and on skin.
- Ingestion of hazardous materials from hand to mouth contact.
- Inhalation of potential volatile contaminants or volatile fraction of potential semivolatile contaminants emitting from the well opening.

Physical/Environmental

- Slips/trips/falls - sloped, uneven terrain.
- Skin irritation from contact with insects and vegetation.
- Interaction with native and potentially hostile animal life.
- Vehicular traffic.
- Explosion from introducing a flame or spark near a methane vent.

Task 6 - Groundwater Sampling

Chemical

- Skin contact with potentially contaminated water.
- Eye contact from splashing water.
- Ingestion of hazardous materials from hand to mouth contact.
- Inhalation of potential volatile contaminants or volatile fraction of potential semivolatile contaminants emitting from the well opening.

Physical/Environmental

- Skin irritation from contact with insects and vegetation.
- Lifting hazards (muscle strain, etc.) while bailing well.
- Cuts from using knives to cut bailer rope.
- Slips/trips/falls - sloped, uneven terrain.
- Interaction with native and potentially hostile animal life.
- Vehicular traffic.
- Explosion from introducing a flame or spark near a methane vent.

Task 7 - Slug Test

Chemical

- Skin contact with potentially contaminated water.
- Ingestion of hazardous materials from hand to mouth contact.
- Inhalation of potential volatile contaminants or volatile fraction of potential semivolatile contaminants emitting from the well opening.

Physical/Environmental

- Slips/trips/falls - sloped, uneven terrain; crawling over and under obstacles.
- Skin irritation from contact with insects and vegetation.
- Interaction with native and potentially hostile animal life.
- Vehicular traffic.
- Explosion from introducing a flame or spark near a methane vent.

Task 8 - Land Surveying

Chemical

- Ingestion of contaminated material from hand to mouth contact.

Physical/Environmental

- Slips/trips/falls - sloped, uneven terrain; crawling over and under obstacles.
- Skin irritation from contact with insects and vegetation.
- Interaction with native and potentially hostile animal life.
- Vehicular traffic.
- Explosion from introducing a flame or spark near a methane vent.

3.4.2 Chemical/Material Hazards

Exposure to hazardous chemicals/materials can occur through various pathways into the body. These pathways include:

- Inhalation of vapors and/or particulates.
- Ingestion of contaminated particulates from hand-to-mouth contact.
- Dermal and eye contact from direct, unprotected contact.
- Absorption through the eye from exposure to concentrations in the air.

The hazardous chemical/material exposure potential for personnel working at the CD Landfill is expected to relate directly to hazardous chemicals/materials detected during previous sampling investigations. These hazardous chemicals/materials consist of cadmium, iron and lead, and possibly asbestos among construction debris, as asbestos-containing building materials. Therefore Tables 1 and 2 identify the chemical/physical properties and exposure symptoms/routes of entry, respectively, for the aforementioned hazardous chemicals/ materials.

TABLE 1

CHEMICAL/PHYSICAL PROPERTIES OF HAZARDOUS CHEMICALS/MATERIALS DETECTED DURING PREVIOUS SAMPLING AT THE CD LANDFILL

Chemical	Source	Highest Concentration Detected (ppm)	Exposure Limit (EL)(a)	IDLH(b)	Vapor Pressure(c)	Specific Gravity(d)
Asbestos (as asbestos-containing building materials)	Landfill Debris	NA	0.2 f/cc	NA (CA)	0 mm	NA
Cadmium (as cadmium dust)	Sediments Subsurface Soils	4.9 28.4	0.2 mg/m^3 C - 0.6 mg/m^3	50 mg/m^3 (CA)	0 mm	8.65
Iron (as iron oxide dust)	Subsurface Soils Surface Water	142,293 38.1	10 mg/m^3	NA	0 mm	5.24
Lead	Subsurface Soils Sediments	4,140 145	0.05 mg/m^3	700 mg/m^3	0 mm	11.34

(a) EL - Exposure Limit = A time-weighted average concentration for a normal eight-hour work day and 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without expected adverse effect. The EL represents published Exposure Levels according to the following hierarchical order: (1) OSHA PELs; (2) NIOSH RELs; (3) ACGIH TLVs; and, (4) other recognized sources.

(b) IDLH - Immediately Dangerous to Life or Health.

(c) Vapor Pressure = Expressed as mm/Hg at 68°F (unless otherwise mentioned).

(d) Specific Gravity = At 68°F (unless otherwise mentioned).

CA - Suspected or Proven Carcinogen
NA - Not Available
f/cc - fibers per cubic centimeter (in air)
ppm - parts per million (in air)
mg/m^3 - milligrams per cubic meter (in air)
Skin - Potential for dermal absorption
C - Ceiling value

TABLE 2

HAZARDOUS CHEMICAL/MATERIAL EXPOSURE INFORMATION

A summary of exposure symptoms/routes of entry for chemicals/materials detected during previous sampling at the CD Landfill is provided in the table below.

Substance	Routes of Entry	Exposure Symptoms
Asbestos (as asbestos-containing building materials)	Inhalation, Ingestion	Dyspnea, interstitial fibrosis, restricted pulmonary functions, finger clubbing (carcinogen)
Cadmium (as Cadmium Dust)	Inhalation, Ingestion	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, mild anemia
Iron (as Iron Oxide Dust)	Inhalation	Benign pneumuconiosis with x-ray shadows indistinguishable from fibrotic pneumoconiosis
Lead	Inhalation, Ingestion, Skin/Eye Contact	Weakness, lassitude, insomnia, facial pallor, pale eye, anorexia, abdominal pain, anemia, gingival lead line, eye irritation, nephropathy

The hazardous chemicals/materials not identified in Tables 1 and 2 consist of total organic halogens (which have not been specifically identified) but may indicate the presence of volatiles, semivolatiles, or pesticides.

By eliminating the potential routes of exposure through the use of engineering controls (safe sampling techniques) and personal protective equipment (chemical protective clothing) the risk of exposure can be effectively eliminated for the aforementioned constituents and reduced for those chemicals identified in Table 1.

Material Safety Data Sheets for those materials listed in Tables 1 and 2 have been compiled, and are included as Attachment B. Procedures to follow in the event of a chemical exposure, are included as Attachment C.

3.4.3 Physical Hazards

3.4.3.1 Confined Space Entry

A confined space entry will not occur at this site, therefore, confined space entry procedures will not be required.

3.4.3.2 Thermal Stress

Provisions for monitoring of heat stress are outlined in Attachment A - Baker Safety SOPs.

3.4.3.3 Explosion and Fire

In general, the following items present potential physical hazards and will be monitored closely:

- Explosion and fire resulting from:
  - Heavy equipment malfunction
  - Penetration into underground utility/service lines (gas, electric, fuel)
  - Ignition of trapped flammable vapors
  - Vehicular accidents

Provisions for monitoring for potential fire/explosive conditions will include the use of an oxygen/combustible gas meter (as indicated in Section 5.2) and the performance of utility checks prior to conducting intrusive activities. As additional concerns are identified, provisions for making changes to the HASP will be presented by the SHSO, as needed.

3.4.3.4 Noise

Elevated noise levels are expected, due to drilling operations and aviation traffic; therefore, hearing protection will be required.

3.4.3.5 Underground/Overhead Utilities

Underground utility clearance must be obtained before any intrusive activities are performed; this clearance will be provided by a base representative for this project. If underground utilities are identified in these areas, the ground above the utility lines are to be physically marked, such as, with spray paint or flags. Baker personnel are to notify the base representatives at least three days prior to soil intrusive activities to acquire a utility clearance. A minimum of a 24 inch tolerance zone must be used for underground utilities. In addition, existing methane gas monitoring stations (vents) are located in the vicinity of the landfill.

The generally accepted uniform color code for underground utilities is as follows:

- Red - Electric power lines, cables, conduit and lighting cables
- Yellow - Gas, oil, steam, petroleum, or gaseous materials
- Orange - Communication, alarm or signal lines, cables or conduit
- Blue - Water, irrigation, and slurry lines
- Green - Sewers and drain lines
- White - Proposed excavation

Energized overhead electric lines may present a risk of electrocution. OSHA standards require that equipment maintain certain distances from power lines. For lines 0 to 50 kilovolts (kV), the minimum distance is 10 feet. Lines carrying over 50 kV require that equipment maintain 10 feet, plus an additional 0.4 inch for each 1 kV over 50.

3.4.3.6 Heavy Equipment

One of the primary physical hazards on the site is associated with the use of heavy equipment. The heavy equipment includes the use of a drill rig.

General hazards associated with the drill rig include moving parts, such as, the auger and cathead. Personnel must remain clear of moving parts and must avoid loose fitting clothing that can become entangled in the moving parts. Personnel working near a drill rig must be aware of the location and operation of the emergency shut off devices. Personnel are to stand clear of the drill rig immediately prior to starting the engine. Due to the expected presence of methane gas, O_2/LEL meters are to be used continuously during drilling operations.

Noise from the operation of the heavy equipment will limit verbal warning abilities. Hand signals will be prearranged between operators and personnel working in and around heavy equipment. Backup alarms must operate properly on the heavy equipment. Only operators trained, qualified, and authorized will be permitted to operate the heavy equipment.

The drilling subcontractor representatives are to provide any other cautions that need to be observed when working around this equipment during the HASP briefing.

3.4.3.7 Vehicular/Air Traffic

Due to recent construction of an access road through the western portion of the landfill, in addition to the airstrip located along the southeastern portion of the landfill, vehicular/air traffic is of a major concern for this site. Personnel will be made aware of these conditions and instructed to proceed cautiously when travelling in and around the landfill. Safety vests, cones, and barracades will be made available to all personnel for use in high traffic areas. Activities conducted near the airstrip will be coordinated with the CNB Security Officer. The need for additional measures will be evaluated on a daily basis.

3.4.4 Radiation Hazards

Although the potential for exposure to radiological wastes or radioisotopes at the CD Landfill, is considered low, a radiation survey meter will be used as a standard operating procedure (Section 5.2 identifies the monitoring requirements).

For alpha and low energy beta particles, protection for site workers will be accomplished by avoiding direct (unprotected) contact with soil, sediment, and groundwater. Additionally, workers will monitor the sampling site with a Geiger-Mueller (GM) pancake tube that will read in counts per minute (cpm). For cpm exceeding twice the background level or greater than 140 cpm, work will stop, personnel will retreat until levels return to, or have gone below background (50 to 70 cpms), and contact the PHSO.

For gamma rays, protection for site workers will not be accomplished by avoiding direct contact with soil, sediment, and groundwater; therefore, workers will monitor the sampling site with a GM pancake tube for low energy gamma emissions, and a gamma scintillator for high energy gamma emissions. The GM operating on a scale of cpm will follow the levels identified above. The gamma scintillator, operating on a scale of uR/hr, will have a stop work level of 1000 uR/hr or 1 mR/hr.

Personnel will be provided instructions on the use of the radiation meter by the PHSO prior to the start of activities. Any additional questions regarding the different types of ionizing radiation, or the operation of the meter will be directed to the PHSO.

3.4.5 Environmental Hazards

Hazardous Flora

Incidence of contact by individuals to poisonous/thorny plants is high (especially during surface water and sediment sampling activities); therefore, bare skin should be covered (i.e., long pants and shirt, steel toe boots, leather or cotton gloves, safety glasses, and head protection) as much as practical when working in forested or densely vegetated areas located adjacent to the drainage ditches. Personnel should avoid entering an area in the direct path of known poisonous flora (i.e., poison ivy/oak), a secondary route should be selected. Care should also be taken when walking in such areas as uneven terrain or vines may present a tripping hazard.

While attempting to cut into dense underbrush, hazards exist from the sharp machete, gas-powered weed cutter, etc. (Note: Hearing protection, steel toe boots, gloves, and safety glasses are required when using weed cutters). Care should be taken when using such devices. All rashes and other injuries will be reported to the SHSO as soon as they are known.

Hazardous Fauna

All animal life must be treated with respect. Without proper training, personnel may not be able to differentiate between dangerous and nondangerous varieties. Working in wet or swampy areas unprotected is not permitted. Contact with surface water will be kept to a minimum.

Mosquitoes and gnats pose a nuisance and physical hazard to field personnel; they distract workers, leading to accidents, and pose a physical threat by transmitting live microorganisms. Avoiding the use of perfumes and scented deodorants and wear light colored clothing whenever possible. The use of Avon's "Skin So Soft" or other insect repellents is encouraged, and will be provided on the site.

There is a potential to come in contact with other dangerous insects. These include fire ants, chiggers, bees, wasps, hornets, mites, fleas, spiders, and ticks.* All personnel should perform "checks" on each other periodically and at the end of the work shift. All insect bites must be reported to the SHSO.

Poisonous snakes such as the rattlesnake, copperhead, and cottonmouth (water moccasin), all known as pit vipers, are common to the United States. Snakes typically do not attack people, but will bite when provoked, angered, or accidentally injured (as when stepped on). When encountering a snake(s), avoid quick/jerky motions, loud noises, and retreat slowly; do not provoke the snake(s). If bitten, follow procedures outlined in Section 8.6, Emergency Medical Treatment.

Prior to initiating site activities, each individual shall be questioned as to any known sensitivities to the previously mentioned organisms or agents.

* *Site personnel have been provided with a copy of Baker's policy (per our medical consultant) regarding the signs and symptoms of exposure for Lyme Disease.*

4.0 SITE CONTROL

4.1 Site Access

- The Site Manager is designated to coordinate overall access and security on site, and will contact Mr. Frank King at NAS Security (444-2737) about proper base security procedures for access when in close proximity to airstrip. Perimeters for activities to be conducted at the CD Landfill will be established according to the site boundary procedures identified in Section 4.3, local conditions, and Navy Activity requirements.

- Personnel will not be permitted within the Work Zone (Exclusion Zone) or Contamination Reduction Zone without proper authorization from the SHSO.

- All personnel arriving or departing the site will be documented in the field log.

- All activities on site must be cleared through the Site Manager and documented in the Field Log.

- Figure 1 identifies the location of the site(s) under investigation.

4.2 Site Conditions

- The prevailing wind conditions are from the Southwest.

- Anticipated weather conditions include temperatures ranging from 55 to 85°, with precipitation.

- The on-site Command Post will be established at the Baker Site Trailer, which will be in the Support Zone and oriented upwind from the Work Zone.

4.3 Work Zones

Level C and B Activities

Work Zones for activities conducted under Level C or higher protection levels shall be established utilizing control boundaries between the Work Zone, the Contamination

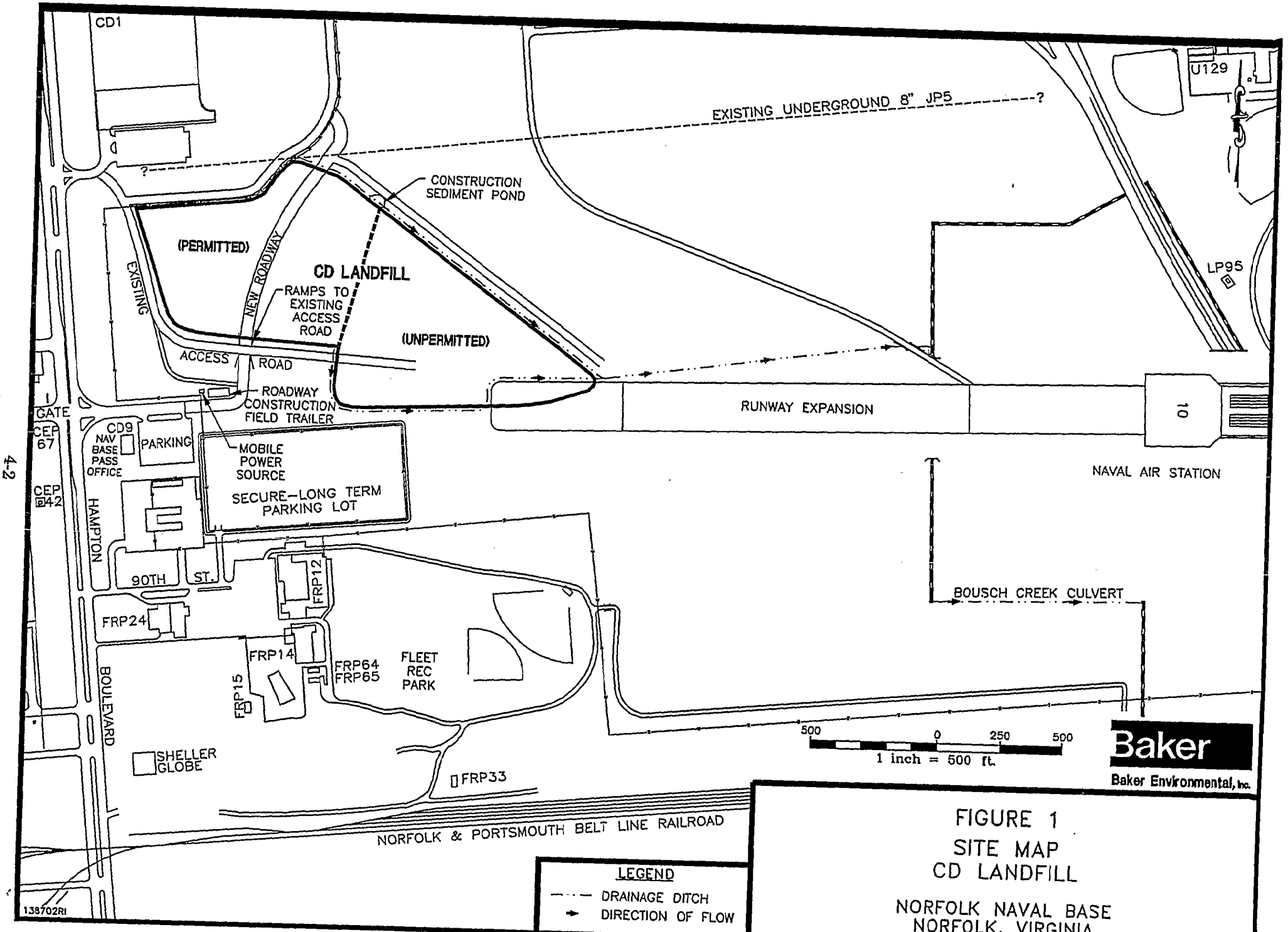


FIGURE 1
SITE MAP
CD LANDFILL

NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

Reduction Zone (CRZ), and the Support Zone (Clean Zone). These boundaries shall be defined as follows:

- Work Zone - The area where the primary site investigative activity occurs.
- Hotline - The boundary between the Work Zone and CRZ.
- CRZ - The area between the Work Zone and the Support Zone (located upwind of the site investigative activities).
- Contamination Control Line - The boundary between the CRZ and the Support Zone.
- Support Zone - The outermost area next to the CRZ and upwind of the site investigative activities.

Each of these boundaries will be demarcated using one or more of the following materials:

- Colored boundary tape, cones, or equivalent for the Hotline, or the Decontamination Corridor of the CRZ.
- Barriers for the Contamination Control Line such as posted signs and/or barricades indicating "Work Area"/"Authorized Personnel Only", or equivalent.

Refer to Figure 2 for a "Typical Contamination Reduction Zone Layout."

Level D and D+ Activities

Populated Areas

Work Zones for activities conducted under Level D or D+ protection levels shall be established in such a manner as to preclude unauthorized personnel from entering the investigative area. A boundary will be established to separate the Work Zone from the Clean Zone using available materials. Such materials may include the Baker Field Vehicle, natural boundaries (buildings, structures, fences), or signs/placards, boundary tape, cones, barricades, etc.

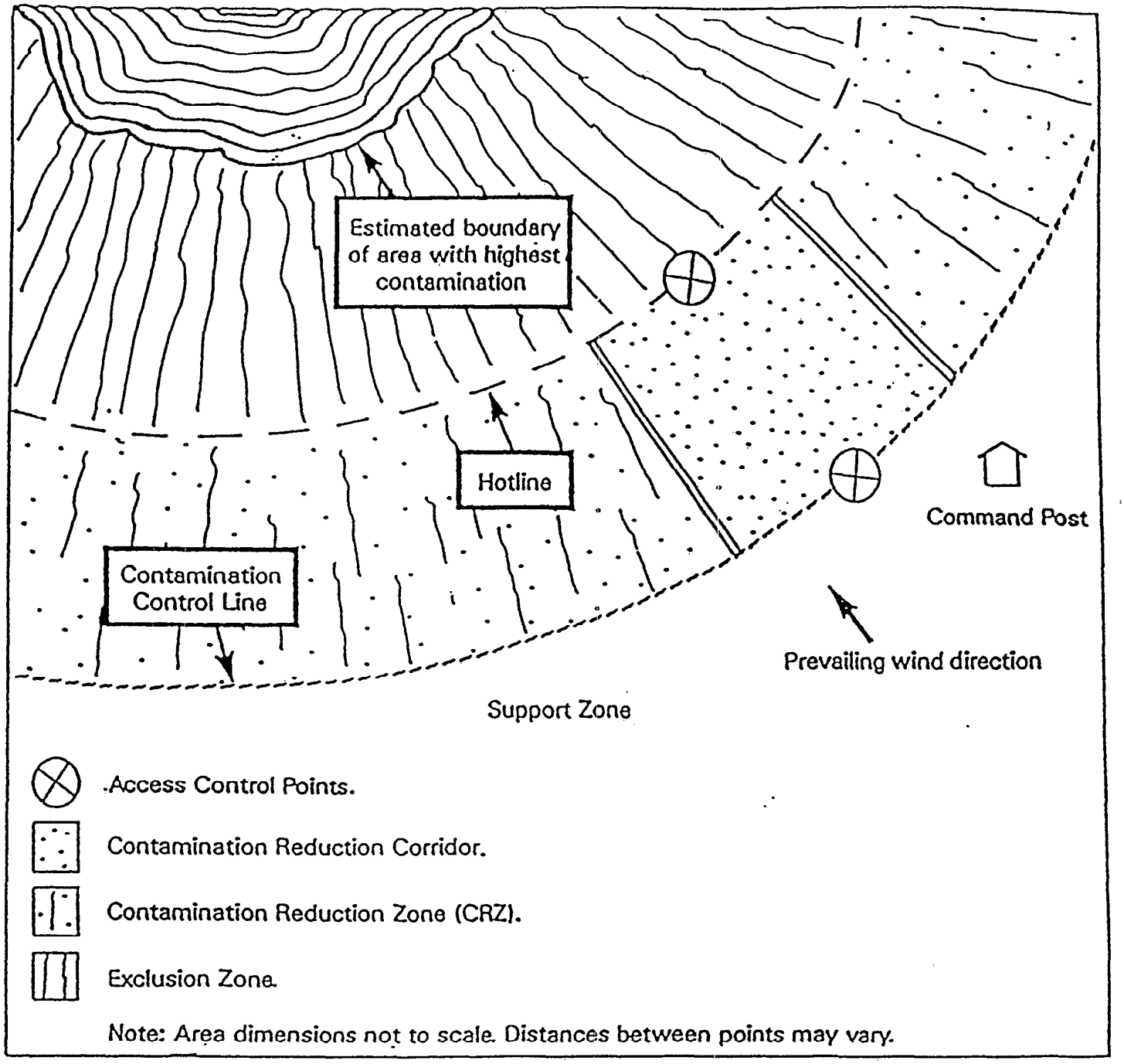


FIGURE 2
TYPICAL CONTAMINATION
REDUCTION ZONE LAYOUT

Unpopulated/Secluded Areas

In unpopulated or secluded areas, the aforementioned materials may not be used due to the exclusive nature of the site, the short duration of the activity, and the low risk to outside populations. The SHSO and/or Field Team Leader is responsible for making this determination.

4.4 "Buddy System"

All site activities that involve hazards and/or the potential for contact with hazardous materials will be performed by a work team of no fewer than two people (Buddy System). For potential "high-hazard" activities, a third person located in the Support Zone will serve as an observer or rescue person.

4.5 Safe Work Practices

Routine safe work practices may consist of:

- Setting up barriers to exclude unauthorized personnel from contaminated areas.
- Minimizing the number of personnel and equipment at the site (s).
- Establishing work zones within the site.
- Establishing control points with regular access to and egress from work zones.
- Conducting operations in a manner to reduce exposure of personnel and equipment.
- Implementing appropriate decontamination procedures.
- Conducting sampling activities from an upwind location.
- Adherence to applicable safety regulations in OSHA standards 29 CFR 1910 and 1926.

4.6 Sanitation/Site Precautions

Provisions for sanitation procedures and site precautions to be followed on site can be found in Attachment A - Baker Safety SOPs.

5.0 ENVIRONMENTAL MONITORING

5.1 Personal Monitoring

The following personal monitoring will be in effect on site:

Personal monitoring will be accomplished using real time environmental monitoring instrumentation directed at the breathing zone (BZ) of work party personnel. BZ monitoring will be performed each time a reading is taken at the point source. The guidelines below identify the protection levels required according to the concentration measured in the BZ.

(1)PID

- Background (2) = Level D/D+
- >1 mu above background for up to 1 continuous minute = Level C
- >1 mu above background for up to 5 continuous minutes = Level B or Stop Work and consult the SHSO
- Instantaneous peak concentrations >10 mu = Level B or Stop Work and consult the SHSO

(1) PID with 10.2 eV ultraviolet lamp set on the 1X scale.
(2) Background is typically 1 to 2 mu (meter units)

5.2 Point Source Monitoring

Point source monitoring is defined by this HASP as monitoring performed at the source of the sampling/investigative activity. Instrumentation to be used will include a PID, Oxygen/Combustible Gas Meter, and Radiation Survey Meter. The action levels for the oxygen/combustible gas meter and radiation meter are identified below.

Oxygen/Combustible Gas Meter*

Combustible Gas Meter

- <10% of the Lower Explosive Limit (LEL) = continue working
- >10% of the LEL* = Stop Work immediately and consult the SHSO

Oxygen Meter

- 19.5% to 22% = continue working
- <19.5% or >22% = Stop Work immediately and consult the SHSO

*Used to evaluate physical safety in conjunction with the PID.

Radiation Survey Meter - Ludlum Model 3-98 Survey Meter with Model 44-2 Gamma Scintillator Tube (external probe)

- Background (typically 0.02 to 0.04 mR/hr) - Continue work
- 0.5 mR/hr to 1 mR/hr - Continue work, monitor levels closely
- >1 mR/hr - Leave work area and consult PHSO

GM Pancake Probe (internal probe)

- Background typically 50 to 70 cpm = Continue work
- Background to 140 cpm = Continue work, monitor levels closely
- >140 cpm = Retreat from work area until background levels are reached and consult PHSO

As work progresses, the scope of monitoring may be extended based on monitoring results, odor detection, changing work conditions, and signs or symptoms of exposure. Any or all of these conditions will be immediately investigated and acted upon by the SHSO.

5.3 Perimeter Monitoring

Perimeter monitoring (defined as monitoring performed at borders beyond the Support Zone and often at the "fence line") for each site will be performed as follows:

- The PID will be used periodically to scan the perimeter as a means of documenting any volatile releases that may extend past the work zone, when volatile concentrations exceed 50 mu at the point source or 10 mu at the breathing zone.

- The Radiation Survey Meter will be used to determine a safe distance from the source (i.e., when levels return to background), if a radiation level exceeding 1 mR/hr or 140 cpm is detected.

5.4 Site-Specific Air Monitoring Equipment and Frequency

Monitoring equipment and frequency for each site can be found in Table 3. Action levels that govern changes in levels of protection can be found in Section 5.1.

TABLE 3

MONITORING EQUIPMENT AND FREQUENCY FOR EACH TASK CONDUCTED AT THE CD LANDFILL

Job Task	PID	Oxygen/ Combustible Gas Meter(1)	Radiation Survey Meter(2)
Sediment/Surface Water Sampling	I&P	NR	I
Land Surveying	NR	NR	NR
Geophysical Investigation	NR	NR	NR
Monitoring Well Installation	C	C	D
Monitoring Well Development	I&P	NR	D
Groundwater Sampling	I&P	NR	D
Soil Boring Sampling	C	C	I&P
Slug Test	I&P	NR	D

I = Initially - At start of job task to confirm designated protection level.
P = Periodically - When site condition or set-up changes, or when a new area is entered.
C = Continuously - Monitor levels continuously.
D = At the discretion of the SHSO.
PID = Photoionization Detector
NR = Not Required

Note: As air concentrations are measured, they should be documented. In the case of continuous monitoring, every 15 to 30 minutes.

(1) Used to evaluate physical safety due to the presence of methane gas.
(2) Refer to the manufacturer's operating manual and the Baker SOP prior to operation.

5.5 Equipment Maintenance and Calibration

Baker's procedures for the return of equipment to inventory and for maintenance of the equipment shall be followed in order to assure that the optimum level of operation is maintained for the item. Equipment calibration under the direction of the SHSO will be completed daily and calibration information entered into the equipment calibration log sheet. The log sheets will be maintained on site for the duration of the project with copies to be given to the Equipment Manager once the equipment has been returned to the office. Procedures for equipment maintenance and calibration can be found in the operating manual provided by the manufacturer (included with each piece of equipment), or in Baker's Standard Operating Procedures for Administrative, Field, and Technical Activities Manual.

5.6 Monitoring Documentation

As environmental monitoring is performed, documentation of the results will be entered into the Field Log Book of the SHSO or other personnel performing the monitoring. Documentation will include the date, time, instrument results, general location, and type of monitoring, such as point source, breathing zone, or area (perimeter). Copies of the logbook will be placed in a binder and remain on site until the end of the field activities, when they will become part of the permanent file.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 Personal Protective Equipment Selection

The personal protective equipment available for the various levels of protection, is listed below.

Item No.	Personal Protective Equipment
1	Chemical-Resistant Clothing (Polyethylene-coated Tyvek®)
2	Chemical-Resistant Clothing (Saranex®)
3	Uncoated Tyvek®/Kleenguard® Coveralls
4	Normal Work Clothes or Coveralls
5	Air-Line Respirator (ALR) with 5-minute escape pack
6	Self-Contained Breathing Apparatus (SCBA) for rescue
7	NIOSH 5-minute Escape Pack (on standby)
8	Full-face Cartridge Respirator
9	Half-face Cartridge Respirator
10	Full-face Cartridge Respirator (on standby)
11	Half-face Cartridge Respirator (on standby)
12	Chemical-Resistant Gloves [Nitrile inner (double layer)]
13	Chemical-Resistant Gloves (Latex inner)
14	Chemical-Resistant Gloves (Rubber/Neoprene outer)
15	Chemical-Resistant Gloves (Nitrile outer)
16	Work Gloves (outer)
17	Chemical-Resistant Overboots (with steel toe and shank)
18	Chemical-Resistant Overboots (w/o steel toe)
19	Steel Toe Boots
20	Safety Glasses
21	Safety Goggles
22	Face Shield
23	Hard Hat
24	Hearing Protection
25	Chest/Hip Waders
26	Safety vests

6.2 Site-Specific Levels of Protection

Based on an evaluation of potential hazards the levels of protection and corresponding personal protective equipment have been designated for the following tasks. Upgrading or downgrading the level of protection will be based on real time monitoring, working conditions, and the discretion of the SHSO.

Note: No single combination of protective equipment and clothing is capable of protection against all hazards; PPE should be used in conjunction with safe work practices, decontamination, and good personal hygiene.

Site(s)	Job Task	Level of Protection(1)					Personal Protective Equipment (Item No.)
		B	C	D+	D	Other	
CD Landfill	Sediment/ Surface Water Sampling			X			4, 10, 12, 15, 17, 20, 25
CD Landfill	Land Surveying				X		4, 16, 19
CD Landfill	Geophysical Investigation				X		4, 16, 19
CD Landfill	Monitoring Well Installation		X			(2)	1, 8, 12, 14, 18, 19, 23, 24
CD Landfill	Monitoring Well Development			X			4, 10, 12, 19, 20
CD Landfill	Groundwater Sampling			X			4, 10, 12, 19, 20
CD Landfill	Soil Boring - Sampling		X			(2)	1, 8, 12, 14, 18, 19, 23, 24
CD Landfill	Slug Test			X			4, 10, 12, 19, 20

(1) Due to the close proximity to vehicular traffic, safety vests will be provided at the site; their frequency of use will be determined by the SHSO during site mobilization and addresses at the pre-entry briefing.

(2) Level B equipment will remain on standby during these operations.

EXCEPT IN EMERGENCY SITUATIONS, CHANGES TO THE SPECIFIED LEVELS OF PROTECTION SHALL ONLY BE MADE WITH THE APPROVAL OF THE SITE HEALTH AND SAFETY OFFICER AND THE SITE MANAGER, IN CONSULTATION WITH THE PROJECT HEALTH AND SAFETY OFFICER AND PROJECT MANAGER.

6.3 Respiratory Protection

Site-specific respiratory protection requirements as outlined below will comply with the procedures in Attachment A - Baker Safety SOPs.

Level B

Either the "North" NIOSH-certified Air Line Respirator (ALR) system (four-person manifold) with 5-minute escape pack or "North" Self-Contained Breathing Apparatus (SCBA) will be used at this level. The line-of-site worker will be equipped with an SCBA on standby for emergency rescue purposes. This individual may also be responsible for monitoring the supplied air system with the SHSO's approval.

Level C

The "North" or "MSA" full-face NIOSH-certified negative pressure Air-Purifying Respirator (APR) with an organic vapor/HEPA cartridge is the appropriate cartridge for use with the detected hazardous materials and the measured contaminant concentrations. Upgrades/downgrades in this level of respiratory protection will be based on measured "realtime" air contaminant concentrations (see Section 5.2) and the SHSO's observations.

Cartridge changeover will occur when one or more of the following have been observed: exposure duration greater than eight hours for vapor/gas cartridges; breathing resistance; a noticeable odor or taste; eye/throat irritation; and other indicators such as end-of-service life indicators for specialty filter cartridges.

Level D+

A NIOSH-certified negative pressure APR, meeting all the requirements identified under Level C, will remain on standby at this level.

6.4 Care and Cleaning of Personnel Protective Equipment

Provisions for the care and cleaning of personnel protective equipment used on site can be found in Attachment A - Baker Safety SOPs.

7.0 DECONTAMINATION PROCEDURES

7.1 Personnel Decontamination

Personnel leaving the Work Zone will be thoroughly decontaminated. The following protocol will be used for the decontamination stations according to levels of protection:

Level D	Level D+	Level C	Level B
1. Equipment drop	1. Equipment drop	1. Equipment drop	1. Equipment drop
2. Boot and glove gross contamination removal*	2. Outer boot and glove wash	2. Outer boot and glove wash	2. Outer boot and glove wash
3. Boot and glove wash*	3. Outer boot and glove rinse	3. Outer boot and glove rinse	3. Outer boot and glove rinse
4. Boot and glove rinse*	4. Tape Removal	4. Tape Removal	4. Tape Removal
5. Tape Removal*	5. Outer boot and glove removal	5. Outer boot and glove removal	5. Outer boot and glove removal
6. Boot removal*	6. Coverall removal/ disposal	6. Coverall removal/ disposal	6. SCBA or escape tank removal
7. Glove removal	7. Inner glove removal/disposal	7. Respirator removal	7. Coverall removal/ disposal
8. Hand/Face wash	8. Hand/face wash	8. Inner glove removal/disposal	8. SCBA or ALR face shield removal
9. Equipment wipe down	9. Equipment cleaning	9. Hand/face wash	9. Inner glove removal/disposal
		10. Respirator cleaning/ sanitizing	10. Hand/face wash
		11. Equipment cleaning	11. Respiratory cleaning/ sanitizing
			12. Equipment cleaning

*Optional - depends on degree of contamination and type of PPE used.

The following decontamination equipment is required for Level C and higher protection levels and recommended for Level D+ protection:

- Two small tubs (one set of wash and rinse water)
- Scrub brush
- Towels*
- Disposable wipes*
- Pressurized sprayers for rinsing
- Contaminated clothing disposal bag or drum*
- Contaminated liquids disposal drum
- Respirator cleaning solution
- Liquinox and water as the decontamination solution

*Minimum for Level D decontamination.

The decontamination liquids and clothing will be contained and disposed according to policy defined in the Sampling and Analysis Plan (SAP).

7.2 Equipment Decontamination

Provisions for the decontamination of equipment will be based on the size and type of equipment used. Specific decontamination procedures for the CD Landfill can be found in the SAP.

7.3 Waste Handling Procedures

The protocols outlined in the SAP for the handling, packaging, storing, and disposing of contaminated materials must be followed to: (1) minimize the risk of off-site exposures that could endanger public health; and (2) limit the potential for liabilities associated with handling, containment, storage, and transportation of contaminated materials. These protocols comply with Baker's SOP on "Handling of Site Investigation Generated Wastes," located in the Standard Operating Procedures for Administrative, Field, and Technical Activities Manual.

8.0 EMERGENCY PROCEDURES

8.1 Pre-Emergency Planning

All applicable Navy/local emergency response contacts (On-Scene Coordinator, Fire Department, Security, Ambulance, Hospital, etc.) at the CD Landfill will be contacted prior to site mobilization activities by the SHSO. During site mobilization, the points of contact will be reconfirmed and if requested, Material Safety Data Sheets will be provided at this time. The information discussed may include:

- A description of site activities.
- Anticipated site hazards.
- Hazardous chemicals to be used on site.
- Expected length of time on site.
- Specific requirements the emergency response facilities may require.
- Confirmation of emergency phone numbers.

8.2 Emergency Coordinator

The SHSO acting as the Emergency Coordinator is responsible for field implementation of the emergency procedures pending the arrival of the On-Scene Coordinator. As the Emergency Coordinator, specific duties include:

- Familiarizing all on-site personnel with the emergency procedures and the emergency coordinator's authority.
- Identifying the nearest telephone in the event of an emergency.
- Communicating site emergency procedures and requirements to all Baker and subcontractor personnel.
- Specifying a backup/alternate Emergency Coordinator.
- Contacting the Navy On-Scene Coordinator and other response groups, as necessary.

7.0 DECONTAMINATION PROCEDURES

7.1 Personnel Decontamination

Personnel leaving the Work Zone will be thoroughly decontaminated. The following protocol will be used for the decontamination stations according to levels of protection:

Level D	Level D+	Level C
1. Equipment drop	1. Equipment drop	1. Equipment drop
2. Boot and glove gross contamination removal*	2. Outer boot and glove wash	2. Outer boot and glove wash
3. Boot and glove wash*	3. Outer boot and glove rinse	3. Outer boot and glove rinse
4. Boot and glove rinse*	4. Tape Removal	4. Tape Removal
5. Tape Removal*	5. Outer boot and glove removal	5. Outer boot and glove removal
6. Boot and glove removal*	6. Coverall removal/ disposal	6. Coverall removal/ disposal
7. Coverall removal*	7. Inner glove removal/disposal	7. Respirator removal
8. Hand/Face wash	8. Hand/face wash	8. Inner glove removal/disposal
9. Equipment wipe down	9. Equipment cleaning	9. Hand/face wash
		10. Respirator cleaning/ sanitizing
		11. Equipment cleaning

*Optional - depends on degree of contamination and type of PPE used.

The following decontamination equipment is required for Level C and higher protection levels and recommended for Levels D and D+ protection:

- Four small tubs (two sets of wash and rinse water)
- Scrub brush
- Towels
- Disposable wipes
- Pressurized sprayers for rinsing
- Contaminated clothing disposal bag or drum
- Contaminated liquids disposal drum
- Respirator cleaning solution
- Liquinox and water as the decontamination solution

Coordination between Baker and subcontractor personnel is the responsibility of the Site Manager. The best means for securing the lines of communication will be determined prior to start-up by on-site project personnel.

Emergency telephone numbers will be placed in the Baker Site Trailer and maintained in each Baker Field Vehicle. The list of emergency phone numbers is presented below.

Facility	Phone Number On-Base Phone	Phone Number Off-Base Phone	Contact*
Security (NAVBASE)	(4) 2324	(804) 444-2324	Response Operator
Security (NAS)	(4) 2737	(804) 444-2737	Mr. Frank King
Fire	(4) 3333	(804) 444-3333	Response Operator
Ambulance (Sewell Point)	(4) 2674	(804) 444-2674	Response Operator
Ambulance (Public)	(9) 911	911	Response Operator
Hospital (Sewell Point)	(4) 2674	(804) 444-2674	Response Operator
Hospital (DePaul)	(9) 889-5111	(804) 889-5111	Emergency Room
Emergency (One Call)	(4) 0716 or 0720	911	Response Operator
Hazardous Waste Dispatcher	(4) 7528	(804) 444-7528	Mr. William Whitmire
Navy On-Scene Coordinator	(5) 8851	(804) 445-8851	Ms. Merrill Ashcraft
Public Works	(4) 4973	(804) 444-4973	Mr. Bruce Davis
Poison Control Center	(9) 722-1131	1-800-722-1131	Response Operator
National Response Center	1-800-424-8802	1-800-424-8802	Response Operator
CHEMTREC	1-800-424-9300	1-800-424-9300	Response Operator

*Remaining points of contact will be identified prior to the start of activities.

8.4 Assembly Area

In the event of an emergency personnel will be instructed to meet at the Baker Site Trailer. Where applicable, personnel will exit the work area through the contamination reduction zone. If the Baker Site Trailer is inappropriate an alternate assembly area will be designated by the Emergency Coordinator in an upwind location from the site before the start of operations. At this location, emergency needs will be provided, such as:

- Assembly for evacuated personnel
- First aid for injured personnel

- Decontamination material
- Communications.

8.5 Emergency Hospital Route

An emergency hospital route map showing the location of the local hospital will be posted at strategic locations throughout the site. Personnel will be informed of the location of the map and the directions to the hospital.

Directions to DePaul Medical Center (Refer to Figure 3):

1. From the CD Landfill, follow the access road out to Hampton Boulevard and turn left, heading south.

2. Follow Hampton Boulevard (Route 337) south for approximately 2 miles until intersecting with Little Creek Road.

3. Turn left onto Little Creek Road and proceed east for approximately 2-1/4 miles until intersecting with Granby Street, then turn right (heading south).

4. Continue on Granby Street until intersecting with Painter Street (approximately 1-1/2 miles) and follow signs for Emergency Room entrance.

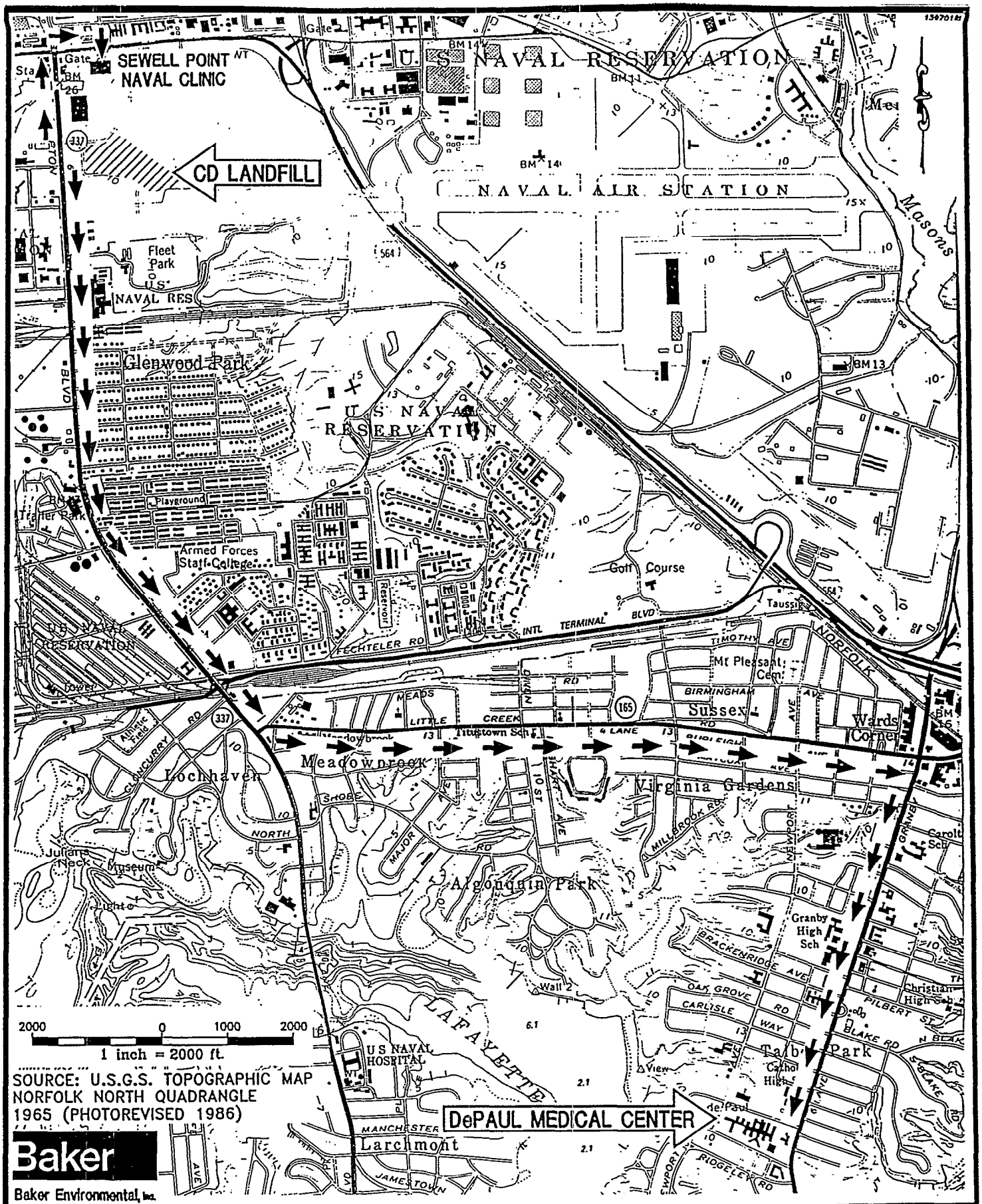


FIGURE 3
EMERGENCY HOSPITAL ROUTE
CD LANDFILL (SITE 6)
NORFOLK NAVAL BASE
NORFOLK, VIRGINIA

8.6 Emergency Medical Treatment

Emergency Services

The nearest public hospital is:

Name DePaul Medical Center

Address 150 Kingsley Lane, Norfolk, Virginia

On-Base Telephone No. (9) 889-5111 (Emergency Room)

Off-Base Telephone No. (804) 889-5111 (Emergency Room)

Note: In emergencies, personnel may be transported to the Sewell Point Clinic (Naval Clinic) for initial treatment.

Local ambulance service is available from:

Name Sewell Point Clinic

Address Intersection of Admiral Taussig and Hampton Boulevard, Building No. CD2

On-Base Telephone No. (4) 2674

Off-Base Telephone No. (804) 444-2674

Contact will be made with emergency personnel prior to the start of activities (see Section 8.1).

There will be a minimum of two persons on each site that will be trained in emergency first aid and CPR.

Physical Injury

If an employee working in a contaminated area is physically injured, first aid procedures are to be followed. Depending on the severity of the injury, emergency medical response from Sewell Point Clinic personnel may be sought to stabilize victim for transport to public hospitals. If the employee can be moved, he/she will be taken to the edge of the work area and decontaminated, if necessary (refer to Section 8.7). Then, if circumstances permit,

administered emergency first aid, and transported to an awaiting ambulance or to a local emergency medical facility.

Chemical Injury

If the injury to a worker is chemical in nature (e.g., direct contact/exposure), the following first aid procedures are to be instituted:

- Eye Exposure - If contaminated solid or liquid gets into the eyes, wash the eyes immediately at the 15-minute emergency eyewash station. Obtain medical attention as soon as possible. Note: Contact lenses will not be worn while at the site.

- Skin Exposure - If contaminated solid or liquid gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If solids or liquids penetrate through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Obtain medical attention immediately.

- Swallowing - If contaminated solid or liquid has been swallowed immediately contact the Peninsula Poison Control Center at (804) 722-1131. Do not induce vomiting in an unconscious person .

- Breathing - If a person has difficulty breathing, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

Snakebite Injury

In the event of a snakebite injury, the following procedures will be followed.

Look for signs and symptoms such as the characteristic appearance of two small holes, usually about a half inch apart, with surrounding discoloration, swelling, and pain. Systematic signs (which may or may not occur) including weakness, sweating, faintness, and signs of shock.

Provide treatment as follows:

1. Calm the victim and keep affected area still.

2. Contact ambulance if victim needs transportation to the nearest hospital.

3. Wash the wound.

4. Keep the affected area below the level of the heart if bite is on the arm or leg.

5. Treat for shock.

6. Monitor airway, breathing, and circulation.

7. Obtain physical description of snake, if possible.

8. Transport victim to the nearest medical facility.

9. Provide the emergency medical responder (either the ambulance attendant or the emergency room at the hospital) with all pertinent information such as: how long ago the bite occurred, the type of snake (if known), any known allergic conditions (if known), etc.

Inform the SHSO immediately if a snakebite has occurred. The SHSO will in turn, inform the PHSO, as soon as possible.

If injuries are not serious or life threatening, affected personnel may be transported by other site personnel to the local medical facility, if necessary. Emergency medical response personnel will be contacted in the event of serious or multiple injuries. Medical personnel will be provided with all available information regarding the nature of the incident, chemicals involved, etc.

Decontamination

If on-site decontamination of injured employee(s) is not possible, the Emergency Coordinator will provide polyethylene sheeting (or equivalent) for a stretcher, and ambulance. If

necessary, a site employee equipped with appropriate protective equipment and clothing will accompany the injured employee and will perform decontamination under the supervision of emergency medical personnel.

Instances requiring treatment beyond "first aid" will be handled at appropriate facilities and reported to the Project Manager and PHSO within 24 hours.

8.7 Emergency Decontamination Procedures

In the event of a medical emergency, patients are to be adequately decontaminated before transfer, if possible. This is to prevent contamination of the medical transport vehicle and medical facility. Emergency personnel decontamination will include the following, depending on the level of protection.*

Level D	Level D+	Level C	Level B
• Equipment drop • Tape, boot, and glove removal • Coverall removal	• Equipment drop • Tape, outer boot, and glove removal • Coverall removal/ disposal • Inner glove removal/ disposal	• Equipment drop • Tape, outer boot, and glove removal • Coverall removal/ disposal • Respirator removal • Inner glove removal/ disposal	• Equipment drop • Tape, outer boot, and glove removal • SCBA or escape tank removal • Coverall removal/ disposal • SCBA or ALR face shield removal • Inner glove removal/ disposal

* If circumstances dictate that contaminated clothing cannot be readily removed, then remove gross contamination and wrap injured personnel with clean garments/blankets, to avoid contaminating other personnel or transporting equipment.

All emergency personnel are to be immediately informed of the injured person's condition and potential contaminants and provided with all pertinent chemical data.

If necessary, one of the site personnel equipped with appropriate PPE may accompany the injured worker and perform decontamination with supervision of medical personnel.

8.8 Personal Protection and First Aid Equipment

PPE available for emergency response will include the following:

- Polyvinyl chloride boots
- Tyvek® suits, polyethylene coated and uncoated

- Nitrile gloves (inner and outer)
- Neoprene and Nitrile Gloves (outer)
- SCBAs

PPE, first aid equipment and the first aid kits will be available in the support zone (i.e., Baker Field Vehicle and Baker Site Trailer).

Emergency and first aid equipment can be found at the following locations:

Fire Extinguisher:	Baker Site Trailer and Contractor Field Vehicle
First aid kit:	Baker Site Trailer and Baker Field Vehicle
Emergency eye wash bottle:	Baker Site Trailer and Baker Field Vehicle
Air Horn:	With Personnel
Emergency Eye Wash Station:	Near Area With Greatest Potential for Chemical Splash/Exposure

8.9 Notification

If the Emergency Coordinator determines that the site has an uncontrolled situation, such as a spill, fire, or explosion, that could threaten human health or the environment, he/she will report their findings to the Navy On-Scene Coordinator and the Hazardous Waste Dispatcher. The notification report will be made from the Baker Site Trailer/Field Vehicle, or other appropriate locations and will include:

- Description of incident (e.g., release, fire).
- Name and telephone number of individual reporting the emergency..
- Location of incident.
- Name and quantity of material (s) involved.
- The extent of injuries, and number of casualties.
- The possible hazards to human health or the environment and cleanup procedures.
- Assistance that is requested.

8.10 Hazard Assessment

The Emergency Coordinator will assess possible hazards to human health or the environment that may result from a chemical release, fire, explosion, or severe weather conditions to the best of his/her abilities, incorporating the following steps, as appropriate.

- Assess the immediate need to protect human health and safety.
- Identify the materials involved in the incident.
- Identify exposure and/or release pathways and the quantities of materials involved.
- Determine the potential effects of the exposure/release and appropriate safety precautions.
- Determine if release of materials meets EPA requirements for reportable quantities for spills under the RCRA or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- Inform appropriate personnel as identified in Section 8.9.

This assessment will consider both the direct and indirect effects of the chemical release, fire, explosion, or severe weather conditions (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated or the effects of any hazardous surface water runoff from water or chemical agents used to control fire and heat-induced explosions).

8.11 Security

During activation of the Emergency Plan, the Emergency Coordinator or his/her designated representative will control access to the site and maintain an incident log until the Navy On-Scene Coordinator arrives. The incident log will include:

- Time of entry.
- Expected exit time.
- Use of team or "buddy" system.
- Task being performed.
- Location of task.
- Rescue and response equipment used.
- Protective equipment being used.

8.12 Emergency Alerting

Personnel Injury in the Work Zone:

- Initiate a verbal warning or one long airhorn blast and move all site personnel to the decontamination control line (for Level D/D+) or the CRZ (for Level C or higher).

- Send the rescue team into the Work Zone (if required) to remove the injured person to the hotline.

- Have the SHSO and/or Site Manager evaluate the nature of the injury, and assure that the affected person is decontaminated according to Section 8.7.

- If required, contact an ambulance and/or the designated medical facility.

No persons shall reenter the Work Zone until an accident investigation is performed by the SHSO and/or the Site Manager.

Personnel Injury in the Support Zone:

- The Site Manager and SHSO will assess the nature of the injury; if the cause of the injury or loss of the injured person does not affect the performance of other site personnel, operations may continue.

- If the injury increases the risk to others, a verbal warning or one long airhorn blast shall be sounded and all remaining site personnel will move to the support zone for further instructions.

- Activities on site will stop until the added risk is mitigated.

Fire/Explosion:

- Initiate a verbal warning or one long airhorn blast and move all site personnel to the contamination control line (for Level D/D+) or the CRZ (for Level C or higher).

- Alert the fire and security departments and move all personnel to a safe distance from the involved area for further instructions.

- Activities will stop until the added risk is mitigated.

Personal Protective Equipment Failure:

- If any site worker experiences difficulty, failure or alteration of protective equipment that affects the protection factor, that person and his/her buddy shall immediately cease work activities, leave the Work Zone, and repair or replace the defective equipment.

- Reentry will not be permitted until the equipment has been repaired or replaced.

Other Equipment Failure:

- If any other equipment on site fails to operate properly, the Field Team Leader shall notify the Site Manager and SHSO to determine the effect of this failure on continuing operations on site.

- If the failure affects the safety of site personnel, work with the equipment will cease until the situation is evaluated and appropriate actions taken.

In all situations, when an on-site emergency results in evacuation of the Work Zone, personnel shall not reenter until:

1. The conditions resulting in the emergency have been corrected.
2. The hazards have been reassessed.
3. The HASP has been reviewed and, if appropriate, modified.
4. Site personnel have been briefed on any changes in the HASP.

8.13 Training

Site personnel will review the details in the Emergency Plan during initial HASP training. The Emergency Plan will be reviewed/rehearsed by site personnel at least monthly or when elements of the plan change.

8.14 Spill Containment Procedures

In the event that a spill of hazardous substances (gasoline, oil, etc.) occurs during the implementation of field activities, spill containment will be utilized to prevent the additional migration of contaminants through the site area. In the event of a spill, measures will be taken to contain the spill and clean it up. For the purpose of this HASP, a spill is defined as a release of a hazardous substance to soils or surface waters. Any release to soils or surface waters equaling or exceeding the reportable quantities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (40 CFR 304) or the EPA Clean Water Act (40 CFR 116 and 177) will be reported to the Navy EIC who in turn will report it to the appropriate authorities within 24 hours.

Specific spill containment procedures will be dependent on the type of materials spilled and the type of environment affected. Potential spill containment procedures may include diking with absorbent material/pads, then removal or containment of the contaminated materials. Spill containment materials will be located within close proximity to the storage area of the hazardous substances in a manner such that the pathway remains accessible and free of obstructions. Spill containment materials available on site will include:

- Plastic
- Absorbent pads
- Vermiculite/ground corn cobs
- Uncontaminated empty drums

9.0 TRAINING REQUIREMENTS

9.1 General

All Baker employees or other personnel entering the site will need to have received training in compliance with the Occupational Safety and Health Administration (OSHA) Standard 29CFR 1910.120. Baker employees engaged in field activities which potentially expose workers to hazardous substances receive a minimum of 40 hours of instruction off site, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor. Key points of the 40-hour training include field demonstrations, respiratory fit testing and training, risk assessment, toxicology, chemical reactivity, use of monitoring equipment, downrange work procedures, site safety procedures, levels of protection, protective clothing, decontamination, and practical field exercises (which include donning, doffing, and working in personal protective ensembles for personal protection Levels A, B, and C).

In addition to the initial 40-hour training program, Baker requires site employees to receive an annual 8-hour refresher training course on the items specified by the 1910.120 standard. The general purpose of the 8-hour refresher is to ensure that personnel retain the knowledge necessary to be adequately protected, and stay current with proper site health and safety procedures.

Baker also requires that personnel involved with on-site employee supervision receive (in addition to 40 hours initial training and three days of supervised field experience) at least eight additional hours of specialized training at the time of job assignment. Training topics include, but are not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedures and techniques. The 8-hour supervisory training is required to ensure that supervisors have the knowledge necessary to understand and use the various Health and Safety Programs and to implement the elements of the HASP. Table 4 provides the appropriate OSHA Training History for Baker Project Personnel.

TABLE 4

OSHA TRAINING HISTORY OF BAKER PROJECT PERSONNEL*

Personnel	Anticipated Site Activities	Training Status
Jeri Trageser	• Project Manager	• 40-hr. training completed: 11/87 • Supervisory training: 6/89 • 8-hr. refresher completed: 3/93 • First Aid Training: 11/91 • CPR Training: 10/92 • Medical surveillance: 10/92
Barbara Cummings	• Project Health and Safety Officer/ Site Health and Safety Officer	• 40-hr. training completed: 10/91 • Supervisory training: 9/91 • 8-hr. refresher completed: 8/92 • First Aid Training: 11/91 • CPR Training: 2/93 • Medical surveillance: 5/93
James Culp	• Site Manager/Project Geologist	• 40-hr. training completed: 8/89 • Supervisory training: 6/93 • 8-hr. refresher completed: 11/92 • First Aid Training: 7/92 • CPR Training: 7/92 • Medical surveillance: 5/92
Michael Smith	• Sampling Technician	• 40-hr. training completed: 9/91 • Supervisory training: 9/91 • 8-hr. refresher completed: 4/93 • First Aid Training: NA • CPR Training: NA • Medical surveillance: 7/93

* Training history for contractor personnel will be maintained at the Command Post.
NA - Not Applicable

9.2 Site-Specific Training

Site-specific training, as discussed in Section 1.3, will consist of an initial health and safety briefing on the information below, after the HASP has been read by site personnel:

- Names of individuals responsible for site health and safety and methods of communicating safety and health concerns.
- Site-specific health and safety hazards.
- Use of PPE.
- Work practices by which employees can minimize risk.
- Safe use of equipment on site.
- Recognition of symptoms and signs of exposure to hazardous materials.
- Sanitation measures.
- Site control measures.
- Decontamination procedures.
- Emergency response procedures.

The SHSO will conduct the initial site-specific training prior to commencement of field activities.

10.0 MEDICAL SURVEILLANCE REQUIREMENTS

This Site-Specific HASP will require that project personnel, who may be exposed to materials having potentially adverse and deleterious health effects, have obtained medical clearance from Baker's Board Certified Occupational Health Physician in accordance with 29 CFR 1910.120(f) prior to entry onto the site. Baker's corporate medical surveillance program establishes a medical baseline and monitors for symptoms of overexposure for individuals who participate in Preliminary Assessments, Site Inspections, Remedial Investigations, Feasibility Studies, and construction-phase services at sites covered by the Department of Labor, Occupational Safety and Health Administration (OSHA), Hazardous Waste Operations and Emergency Response Standard, 29 CFR 1910.120. Additionally, the program is intended to determine the individual's capability for performing on-site work, including wearing respiratory protective equipment.

All Baker employees that will be engaged in site activities covered by the 1910.120 standard receive a Group III physical examination by a licensed physician who is provided information on the individuals site activities, and exposure or anticipated exposure levels. This exam is received initially, then once every 12 months thereafter. More frequent medical examinations, consultations, and/or laboratory testing will be provided if the examining physician determines that an increased frequency of examination is required. A complete Group III medical exam includes parameters such as height, weight, vision, temperature, blood pressure, and a complete review of occupational and medical histories. Other tests in a Group III exam include chest x-rays, electrocardiogram, spirometry, urinalysis, and blood tests. Table 5 describes the medical surveillance testing parameters performed annually on Baker employees.

Prior to entry onto the site, all personnel, including subcontractors, will be required to provide medical clearance information from their company physician, to the SHSO, stating that they are physically capable of performing the activities required. Medical clearance documents will be kept on file in the site trailer and will be transferred to the project file at the completion of field activities.

TABLE 5

MEDICAL SURVEILLANCE TESTING PARAMETERS*

Group II - Individuals Occasionally in the Field (10-30 days/year)

- Medical History (Physical Exam)
- Eye Exam
- EKG (baseline and for individuals over 40 years of age)
- Chest X-ray (baseline then every 5 years)
- Spirometry
- CBC with differential
- SMA 12 or 26 (liver enzyme scan)

Group III - Individuals Frequently in the Field (>30 days/year)

- Medical History (Physical Exam)
- Eye Exam
- EKG (baseline then annually for individuals over 40 years of age)
- Audiometry
- Chest X-ray (baseline then every 3 years)
- Spirometry
- CBC with differential
- SMA 12 or 26 (liver enzyme scan)
- Urinalysis (glucose scan)
- Specific Blood and Urine Tests (dependent on field exposure)**

Group III with Asbestos - Individuals frequently in the field whom also work with asbestos

- Group III testing with the Asbestos Medical Questionnaire w/Pulmonary Function Test ($FVC_{1.0}$ and $FEV_{1.0}$)

* The attending physician has the right to reduce or expand the medical monitoring on an annual basis as he/she deems necessary.

** To be performed for individuals identified by the attending physician as being chronically exposed to organic compounds.

11.0 HEALTH AND SAFETY PLAN APPROVAL

This HASP has been reviewed by the following personnel prior to submission to LANTDIV.

Barbara Cummings	PHSO	Jeri R. Trageser for Barb Cummings
Name (print)	Title (print)	Signature
Jeri Trageser	Project Manager	Jeri R. Trageser
Name (print)	Title (print)	Signature
Richard Aschenbrenner	Senior Technical Review	Thomas E. Hutchens for Richard Aschenbrenner
Name (print)	Title (print)	Signature

12.0 DECLARATION OF HASP REVIEW

All site personnel indicated below, have reviewed and are familiar with this Health and Safety Plan.

1. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

2. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

3. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

4. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

5. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

6. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

Declaration of Health and Safety Plan Review (Continued)

7. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

8. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

9. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

10. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

11. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

12. _____ _____
(Name-Print) (Company)

_____ _____
(Name-Sign) (Date/Time)

Attachment A
Baker Environmental, Inc.
Safety Standard Operating Procedures

ATTACHMENT A

BAKER ENVIRONMENTAL, INC.
SAFETY STANDARD OPERATING PROCEDURES

TABLE OF CONTENTS

*Not Applicable

2.0 - RESPIRATORY PROTECTION PROGRAM

2.1 INTRODUCTION

In accordance with OSHA requirements (29 CFR 1910.134), this document represents Baker Environmental, Inc.'s (Baker's) program governing the selection and use of respiratory protection for its employees. It is Baker's policy to provide its employees with the proper protective equipment, training, and medical surveillance necessary to protect individuals from any potential hazards which may be present during the tasks performed throughout the course of each individual's employment. This program specifically describes the procedures which have been established and implemented for the use of respiratory protection equipment. The effectiveness of this program shall be reevaluated on an annual basis and appropriate changes shall be made if deemed necessary.

2.2 EMPLOYER RESPONSIBILITY

Baker shall provide its employees the respiratory protection equipment which is appropriate and suitable for the purpose intended, when such equipment is necessary to protect the health of the employee.

2.3 EMPLOYEE RESPONSIBILITY

The employee shall use the respiratory protection provided in accordance with instructions and training received, and shall report any malfunction of the equipment to a responsible person. The employee shall not wear contact lenses in atmospheres where respiratory protection is required. Corrective lens inserts will be provided, at Baker's expense, for employees who require corrective lenses.

2.4 HAZARD ASSESSMENT

The key elements of a respiratory protection program must start with an assessment of the inhalation and ingestion hazards present in the work area. Because Baker's services involve a variety of environmental and industrial hygiene studies, it is not practical to identify all

possible hazards to which all employees could be exposed within the scope of this document. Therefore, it is essential that a task specific assessment be conducted prior to the initiation of any activities on a given project. This task specific assessment may be part of the site-specific Health and Safety Plan.

After a task-specific assessment is completed and it is determined that airborne exposure concentrations exceed or may exceed the recommended limits, engineering and administrative controls should be implemented, whenever feasible.

If the exposure cannot be reduced, or it is not feasible to reduce the airborne exposure below the recommended limits, respirators will be selected by the Site Health and Safety Officer on the basis of:

- Toxicity
- Maximum Expected Concentration
- Oxygen Levels
- Warning properties of the substance(s) involved
- Sorbent Limitations
- Facepiece Fit
- Mobility Requirements
- Type of Use (routine, escape, or emergency entry)
- Possibility of Ingestion of Toxic Materials
- Respirator Attributes

2.5 TRAINING

Each respirator wearer shall be given training, by a qualified individual, which will include explanations and discussions of:

- Opportunity to wear respiratory protection in an uncontaminated environment.
- Respirator Fit Testing (qualitative)
- The respiratory hazard(s) and what may occur if the respirator is not used properly.
- The reasons for selecting a particular type of respirator.
- The function, capabilities, and limitations of the selected respirator.
- The method of donning the respirator and checking its fit and operation.
- The proper wearing of the respirator.

- Respirator maintenance, repair, and cleaning.
- Recognizing and handling emergency situations.

Respirator training will be conducted on an annual basis, at a minimum. Records of the training and fit-testing will be maintained for a minimum of 30 years following termination of employment for each employee.

2.6 TYPES OF RESPIRATORS

Baker provides employees with the North Brand half-face (Model 7700) and full-face (Model 7600) air purifying respirators, positive pressure 30-minute Self-Contained Breathing Apparatus (SCBAs) (Model 800), positive pressure supplied airline respirators, with 5-minute escape air cylinders (Model 85500). Only respiratory equipment certified by the appropriate approval agencies (e.g., NIOSH, MSHA) according to Title 30, Part II of the Code of Federal Regulations, will be distributed to Baker employees. As an alternate air purifying respirator, Baker will also keep, on-hand, the MSA ultra twin full-face respirator. All Baker employees who regularly perform tasks requiring respiratory protection will be issued their own half-face or full-face respirator, provided the employee can achieve a proper fit and is medically capable of wearing the equipment.

Because 30-minute SCBAs, positive pressure supplied airline respirators, and 5-minute escape air cylinders are used less frequently, this equipment will be distributed on an as-needed basis.

2.7 AIR QUALITY

Liquid air used for respiration shall be of high purity. Breathing air shall meet at least the requirements of the specification for Grade D Breathing Air (or higher) as described in Compressed Gas Association Commodity Specification G-7.1-1966. Breathing air may be supplied to respirators from cylinders; oxygen must never be used with air-line respirators.

Air cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 178). Air-line couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of air-line respirators with nonrespirable gases or oxygen.

Breathing gas containers (air cylinders) shall be marked in accordance with American National Standard Method of marking Portable Compressed Gas Containers to Identify the Material Contained, A48.1-1954; Federal Specification BB-A-1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG-B00675b, April 27, 1965, Breathing Apparatus, Self-Contained.

Breathing air, as supplied by air compressors, shall be of high purity and meet the requirements of the specification for Grade D Breathing air (or higher) as described in Compressed Gas Association Commodity Specification G-7.1-1966.

The compressor for supplying air shall be equipped with necessary safety and standby devices. A breathing air-type compressor shall be used. Compressors shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in the event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide to insure that it meets the specifications outlined above.

2.8 CLEANING AND MAINTENANCE

Respirator maintenance will be performed by each trained individual on a regular basis. The maintenance shall be carried out in a manner that ensures that each respirator wearer is provided with a respirator that is clean and in good operating condition.

Respiratory equipment that is used on an as-needed basis shall be maintained by qualified personnel. This equipment shall be cleaned/sanitized, then rinsed and air-dried, after each use. Inspections shall be conducted before and after each use.

Respiratory equipment that has been issued to an employee shall be cleaned/sanitized then rinsed and air-dried by the wearer, (specified by OSHA in 29 CFR 1910.134) which ensures that it will be maintained in clean and good operating condition. Inspections shall be conducted on a regular basis during usage and prior to each project requiring the potential usage of the equipment.

All respirators shall be stored in a plastic bag within a cool/dry location, in a manner that will protect them against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. They shall be stored to prevent distortion of rubber or other elastomer parts.

Parts replacement and repairs shall be performed only by appropriate personnel. Equipment requiring repairs shall be reported to appropriate Baker personnel. Examples of inspection forms are included at the end of this text.

2.9 FIT-TESTING

Each respirator wearer shall be provided with a respirator that can properly form a secure face to mask seal. Each wearer shall be fit-tested prior to issuance of the respirator using either an irritant smoke or odorous vapor, or other suitable test agent (see example of form at end of text). Retesting shall be performed, at a minimum, on an annual basis or if a different model respirator, other than the model he/she was previously fit-tested for, is to be used by the wearer. Air purifying respirators fit-tested qualitatively will be assigned a protection factor of 10 (APF = 10).

Facial hair, which interferes with the normally effective face to mask seal, is prohibited. Each respirator wearer shall be required to check the seal of the respirator by negative and positive pressure checks prior to entering a harmful atmosphere.

2.10 MEDICAL SURVEILLANCE

Personnel who are or may be assigned to tasks requiring use of respirators shall participate in a medical surveillance program on an annual basis. The medical surveillance program shall include, but may not be limited to, a physical and a pulmonary function test conducted by the company's physician and at the expense of the company. Test parameters included in Baker's medical surveillance program is included as Attachment A in each site-specific Health and Safety Plan.

2.11 LIMITATIONS

Wearing any respirator, alone or in conjunction with other types of protective equipment, will impose some physiological stress on the wearer. Therefore, selection of respiratory protective

devices will be based on the breathing resistance, weight of the respirator, the type and amount of protection needed as well as the individual's tolerance of the given device. Additional concerns regarding the limitations of different types of PPE and the monitoring requirements for heat stress/strain will be addressed in the "Heat Stress" SOP.

Baker

Baker Environmental, Inc.

FULL-FACE AND HALF-FACE RESPIRATOR INSPECTION FORM

Inspection Date	Type	FACE PIECE					HEADSTRAPS OR HEADBANDS		RESPIRATOR INTERIOR		
		Clean and Sanitized	No Cracks, Tears, or Holes	Proper Shape and Flexibility	Air Purifying Element Holders Operate Correctly	Proper Storage Free From Heat, Dirt, Sunlight, etc.	No Signs of Wear or Tears	Buckles Function Properly	No Foreign Material Under Valve Seat	No Cracks or Tears in Valves or Valve Bodies	Valve Covers and Bodies in Good Condition and Installed Correctly

✓ = OK X = Not OK

Baker

Baker Environmental, Inc.

SCBA AND SAR (WITH 5-MINUTE ESCAPE TANK) DAILY INSPECTION FORM

Type (SCBA or SAR)	Cylinder Condition (Damaged or Undamaged)	Cylinder (Full or MT)	Facepiece and Hoses (Damaged or Undamaged)	Connections (Damaged or Undamaged)	Apparatus Complete (Yes/No)	Cleaned and Sanitized (Yes/No)	Remarks	Inspected By (Initials)	Date Inspected

RESPIRATOR FIT TEST RECORD

Baker
Baker Environmental, Inc

TEST SUBJECT NAME _____
(last) (first) (initial)

DATE _____ DEPARTMENT _____

SEX (M/F) _____ AGE _____ SOCIAL SECURITY NUMBER _____

RESPIRATOR MEDICAL DATE _____ RESPIRATOR TRAINING DATE _____

SPECIAL/UNUSUAL CONDITIONS/CONSIDERATIONS:

___ Claustrophobia
___ Facial hair
___ Eyeglasses
___ Contacts
___ Other: _____
___ Scars
___ Broken or crooked nose
___ Extreme facial dimensions
___ Wrinkles

RESPIRATOR SELECTION

Manufacturer/Model	Size	Style	
_____	S ___ M ___ L ___	Half ___ Full ___	Pass ___ Fail ___
_____	S ___ M ___ L ___	Half ___ Full ___	Pass ___ Fail ___
_____	S ___ M ___ L ___	Half ___ Full ___	Pass ___ Fail ___

Testing Agent	Qualitative Test	Sensitivity Check
Isoamyl Acetate	Yes: ____ No: ____	Yes: ____ No: ____
Irritant Smoke	Yes: ____ No: ____	Yes: ____ No: ____

TEST EXERCISES
(Check all that apply)

Normal Breathing _____
Deep Breathing _____
Head, Side to Side _____
Head, Up and Down _____
Talking _____
Running _____
Bending _____
Rainbow Passage _____

COMMENTS: _____

_____

Signed: _____ Signed: _____
(Test Subject) (Technician/Instructor)

3.0 - CARE AND CLEANING OF PERSONAL PROTECTIVE EQUIPMENT

3.1 INTRODUCTION

The following procedures cover the care and cleaning of Levels D, C, and B personal protective equipment. Note: These are general procedures that apply to most situations and are not all inclusive. Procedures are subject to change at the direction of the Site Health and Safety Officer (SHSO).

3.2 EQUIPMENT CARE

3.2.1 Chemical Resistant Suit (Levels C and B)

- Before donning, inspect suit for holes or tears; check to see that zippers are operable; and look for signs of suit degradation.

- When wearing, avoid contact with contaminated material where possible; be aware of sharp objects that can tear suit; periodically look over suit to check for major rips or tears.

- While decontaminating, remove gross excess of material from suit; remove suit so that material does not contact inner suit; place clothing in properly labeled disposal containers.

3.2.2 Inner/Outer Gloves (Levels D+ through B)

- Look for rips, tears, or degradation of material. Replace as necessary or at the direction of the SHSO.

3.2.3 Chemically Resistant Boots (Levels D+ through B)

- Nondisposable boots are to be examined on a daily basis before and after use. Disposable boots should be examined prior to donning and while in use, and disposed according to site procedures.

3.2.4 Safety Shoes/Boots (Levels D through B)

- Examine daily for gouges, open seams, etc., anything that would lessen the integrity of the boot. Replace as shoe/boot becomes worn.

3.2.5 Hard Hats (Levels D through B)

- Should be visually inspected before donning for fit, cracks, and overall condition.

3.2.6 Safety Glasses/Goggles (Levels D and C)

- Should be visually inspected before donning for cracks, deteriorated parts, and overall condition. Replace as necessary.

3.2.7 Respirators (Levels C and B)

- Procedures for care of respiratory protective equipment are covered in Baker's SOP for Respiratory Protection.

3.2.8 Hearing Protection (Levels D through B)

- Disposable - Replace daily, or as material becomes worn or dirty.
- Reusable - Inspect before use, clean regularly, replace parts as necessary.

3.3 EQUIPMENT CLEANING

General procedures for cleaning of equipment are listed below. Site-specific concerns will be addressed by the SHSO prior to and during site activities. Cleaning of respiratory equipment is covered under the "Respiratory Protection Program" SOP.

3.3.1 Gross Physical Removal

Large amounts of contaminated soil is scraped off with a tongue depressor, or wiped off using a disposable wipe.

3.3.2 Physical/Chemical Removal

The residual contamination will be scrubbed with a soft-bristled, long-handled brush using a nonphosphate detergent solution.

3.3.3 Rinsing/Dilution

The detergent solution and residual contaminants will be rinsed with tap water using a pressurized sprayer.

Baker Environmental, Inc.

4.0 - SANITATION/SITE PRECAUTIONS

4.1 SANITATION

- A supply of clearly marked potable water, tightly closed, and equipped with a tap.
- Single service disposal cups.
- Outlets for non-potable water, clearly marked, for fire fighting, or other purposes. Cross-contamination of the potable supply shall be prevented.
- One toilet facility which is either chemical, recirculating, combustion, or flush, depending on local code requirements.
- A place for food handling meeting all applicable laws, otherwise, suitable alternatives to such facilities will be provided (i.e., nearby restaurants, food wagons, etc.).
- Clean wash water will be available in the decontamination zone and the Baker Site Trailer. Disposable towelettes will be available in each Baker Field Vehicle, for periodic cleanups.

4.2 SITE PRECAUTIONS

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material, is prohibited in any area designated as contaminated. Smoking will also not be allowed in areas where flammable materials are present.
- Hands and face must be thoroughly washed before breaking for meals and upon leaving the site.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- "Contaminated" work garments are not to be worn off site.

- Contact lenses are not permitted to be worn on site.

- No facial hair which interferes with a satisfactory fit of the mask-to-face seal, is allowed on personnel who are or may be required to wear respirators.

- Contact with contaminated or potentially contaminated surfaces should be avoided. Wherever possible, do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, sit or place equipment on drums/containers.

- Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel where the potential for absorption, inhalation, or ingestion of toxic substances exist unless specifically approved by a qualified physician. Alcoholic beverage intake should be minimized or avoided during after-hour operations.

- Alcoholic beverages and fire arms are prohibited on site.

- All personnel will observe any posted sign, warning, fence, or barrier posted around contaminated areas.

5.0 HEAT STRESS

Monitoring

Provisions for monitoring for heat stress will be determined by the SHSO and performed as outlined below.

Heat stress monitoring is required for personnel wearing semipermeable or impermeable protective outerwear when there is an ambient air temperature greater than 70°F. One or more of the following procedures will be implemented when this condition exists:

1. Increased awareness of heat stress symptoms and buddy monitoring.
2. Fluid intake discipline.
3. Self monitoring of urine output quantities to prevent dehydration.
4. Work-rest intervals.
5. Calculate the Heat Exposure Threshold Limit Value (TLV) for work-rest intervals using the following steps:
    a. Calculate the WBGT (Wet Bulb Globe Temperature) Index using the Quest® Heat Stress Monitor
    b. Estimate the work load using the following guidelines:
        (1) Light work = sitting or standing to control machines, performing light hand or arm work.
        (2) Moderate work = walking about with moderated lifting and pushing.
        (3) Heavy work = pick and shovel work.
    c. Evaluate the calculations against the following Heat Exposure TLVs in °C or °F.

Work - Rest Regimen	Work Load		
	Light	Moderate	Heavy
Continuous work	30.0 (86)	26.7 (80)	25.0 (77)
75% work - 25% rest, each hour	30.6 (87)	28.0 (82)	25.9 (78)
50% work - 50% rest, each hour	31.4 (89)	29.4 (85)	27.9 (82)
25% work - 75% rest, each hour	32.2 (90)	31.1 (88)	30.0 (86)

* For unacclimatized workers, the permissible heat exposure TLV should be reduced by 2.5°C.

Special Considerations

- Clothing - Subtract 2 from the TLV to compensate for the use of semipermeable clothing.
- Acclimatization - After approximately a week, workers should have acclimated themselves to their environment.
- Fitness - Physically fit workers will adjust more readily to a change in environment.
- Medication - Some medications can predispose individuals to heat-induced illnesses.

Causes and Symptoms

The following heat stress causes and symptoms are provided for buddy monitoring purposes. Site personnel must realize that monitoring the physical condition of fellow personnel in Level B and C protective ensembles will be difficult.

1. *Heat rash* results from continuous exposure to heat or humid air.
2. *Heat cramps* are caused by heavy sweating and inadequate fluid intake. Symptoms include muscle spasms and pain in the hands, feet, and abdomen.
3. *Heat exhaustion* occurs when body organs attempt to keep the body cool, due to inadequate fluid intake and personnel not acclimated to the environment. Symptoms include pale, cool, moist skin; heavy sweating; and dizziness.

4. *Heat stroke* is the most serious form of heat stress. It is a MEDICAL EMERGENCY. Symptoms are red, hot, dry skin; lack of perspiration; nausea; dizziness and confusion; strong, rapid pulse rate; and coma.

The need to seek medical attention and the urgency in seeking medical attention depends on the symptoms and the severity of the symptoms displayed by the affected individual. If *heat stroke* is noted or suspected, medical attention must be sought IMMEDIATELY. Efforts should be taken to cool the body to prevent serious injury or death. Excessive cooling can cause hypothermia and should be avoided.

Prevention

Fluid intake should be increased during rest schedules to prevent dehydration. Drinking cool water is best; however, diluted electrolyte solutions (i.e., Gatorade or equivalent) can be substituted for water. Each individual should monitor their urine output and adjust their fluid intake to ensure that urine output and urine color are close to normal. Additional means for preventing heat-induced illnesses may include providing shelter or cooling devices, such as vests and showers.

Attachment B
Material Safety Data Sheets

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 15
Asbestos and Asbestos-containing Materials

Issued: 11/90

Section 1. Material Identification 33

Asbestos and Asbestos-containing Materials Description: Asbestos is a generic term applied to many naturally occurring, hydrated silicates (minerals) found in rock which separate into flexible fibers when crushed or processed. Commercially important forms are amosite, anthrophyllite (mined and used only in Finland), chrysotile, and crocidolite. Other types include tremolite and actinolite. Most widely used in US industry is chrysotile, a fibrous form of serpentine. Since asbestos is insensitive to chemical attack and incombustible, there are over 2000 uses as processed fiber. It is added to such diverse materials as cement, vinyl, plaster, asphalt, and cotton, although due to its health hazards other materials are now replacing it wherever possible. Its use is now limited to products that bind fibers within the product. The largest use of asbestos is in asbestos cement for pipes in water supply, sewage disposal, and irrigation systems; ducts; and flat and corrugated sheets for a wide variety of construction applications. Other uses include fire-resistant textiles, floor tiles, underlayment and roofing papers, friction materials (brake linings), reinforcing filler in elastomers for packing and gaskets, reinforcing pigment in surface coatings and sealants, thermal and electrical insulation media, as a component of taping compound and industrial talcs, and as filler in industrial greases. About 98% of crocidolite is used in production of asbestos cement pipe. Between 1950 and 1972 asbestos was used as spray insulation in buildings, but OSHA now prohibits spray application of actinolite, anthophyllite, asbestos, or tremolite (29 CFR 1910.1001).

R 0
I 4
S 1
K 0
Genium

HMIS
H 3
F 0
R 0
PPG*
* Sec. 8

Other Designations: CAS No. 12172-73-5, amosite, brown asbestos; CAS No. 1332-21-4, asbestos; CAS No. 12001-29-5, chrysotile, white asbestos; CAS No. 12001-28-4, crocidolite, blue asbestos; Ascarite; earth flax; mountain cork; stone flax.
Molecular Formulas: Amosite, $(FeMg)SiO_3$; anthophyllite, $(MgFe)_7Si_8O_{22}(OH)_2$; chrysotile, $3MgO{\cdot}2SiO_2{\cdot}H_2O$; crocidolite, $NaFe(SiO_3)_2{\cdot}FeSiO_3{\cdot}H_2O$; tremolite, $Ca_2Mg_5Si_8O_{22}(OH)_2$.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.
Cautions: Asbestos causes three specific diseases: asbestosis (fibrous lung scarring), lung cancer, and mesothelioma (cancer of the chest lining and abdominal cavities). Prevent or maintain exposures at the lowest feasible level.

Section 2. Ingredients and Occupational Exposure Limits

	1989 OSHA PELs*			1990-91 ACGIH TLVs	1988 NIOSH REL
Asbestos	TWA: 0.2 f/cc†	Action Level TWA: 0.1 f/cc	Excursion Limit: 1.0 f/cc‡	TWA: 2.0 f/cc§	0.1 f/cc
Amosite	0.2 f/cc	0.1 f/cc	1.0 f/cc	0.5 f/cc	0.1 f/cc
Chrysotile	0.2 f/cc	0.1 f/cc	1.0 f/cc	2.0 f/cc	0.1 f/cc
Crocidolite	0.2 f/cc	0.1 f/cc	1.0 f/cc	0.2 f/cc	0.1 f/cc

1985-86 Toxicity Data for Asbestos (CAS No. 1332-21-4)**
Human, inhalation, TC_{Lo}: 1.2 fb/cc, continuous exposure over 19 years. Toxic to lungs.
* OSHA has proposed a lower asbestos exposure limit of 0.1 f/cc as an 8-hr TWA (*Industrial Safety and Hygiene News*, 8/90).
† Fiber/cm³
‡ Average over a 30-min sampling period.
§ As determined by membrane filter method at 400 to 450X magnification (4-mm objective) phase contrast illumination. Fibers longer than 5 µg and with an aspect ratio ≥ 3:1 (ACGIH).
** See NIOSH, *RTECS* (CI6475000), for additional toxicity data.

Section 3. Physical Data

Melting Point: Decomposes
Water Solubility: Insoluble (breaks down slowly in hot water)
Molecular Weight: Varies with asbestos form (Sec. 1)
Appearance and Odor: White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None rpeorted	UEL: None reported

Extinguishing Media: Asbestos is nonflammable. Use dry chemcial, CO_2, water spray, or regular foam. Do not scatter spilled material with high-pressure water streams. **Special Fire-fighting Procedures:** Isolate hazard area and deny entry. Since there may be airborne asbestos fibers, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode; structural firefighter's protective clothing provides limited protection. If feasible, remove containers from fire area. Avoid dust generation. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Develop decontamination procedures for protective clothing and equipment.

Section 5. Reactivity Data

Stability/Polymerization: Asbestos is inert under ordinary room temperature and heated use conditions. It is heat resistant, but decomposes and alters its microscopic fiber structure above 600 °C (1112 °F). Chrysotile dehydroxylates at 1112 to 1436 °F (600 to 780 °C); the "asbestos anhydride" in turn breaks down to a mixture of silica (SiO_2) and fosterite (Mg_2SiO_4) at 1472 to 1562 °F (800 to 850 °C). Above 1832 °F (1000 °C) magnesium pyroxenes form and melt at ~2642 °F (1450 °C). **Chemical Incompatibilities:** Strong acids can attack chrysotile and rapidly extract its MgO and H_2O content; glacial acetic acid can decompose it. Hot water slowly breaks down chrysotile. Like other asbestos forms, it resists strong alkali (5M NaOH at least up to 100 °C).

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, OSHA, and ACGIH list asbestos as a human carcinogen. **Summary of Risks:** Asbestos may cause 1) asbestosis, 2) lung cancer, 3) mesothelioma, 4) pleural plaques, and 5) several other forms of cancer. *Asbestosis* is fibrosis (scarring) of lung tissue after many years of high-level occupational exposure. Scarring may be progressive even after exposure ceases. Even though detectable in lungs of a high proportion of adults in industrialized areas, asbestosis does not result from lower level environmental exposure. Its symptoms range from mild shortness of breath and dry cough to severe disabling breathlessness, heart failure, and ultimately death. Lung scarring can be seen on X-ray and alterations in lung function can be detected with spirometry (a medical test). Examination typically detects rales (crackling sounds in lungs). Severe cases may have cyanosis (bluish skin discoloration) and clubbing of fingertips. *Lung cancer* can result from lower exposure levels than asbestosis, but also takes many years to develop. Smokers exposed to asbestos are at 5 to 10X higher risk than exposed nonsmokers. *Mesothelioma* is a very aggressive cancer of the pleura (lining around the lungs) or peritoneum (lining of the abdomen), and develops after decades of (sometimes low level) exposure. Symptoms may include chest and abdominal pain, weight loss, and/or shortness of breath, with death within 2 years of diagnosis. *Pleural plaques* are thickenings, sometimes with calcium deposits, of the lungs's lining and may be seen on X-ray. While not associated specifically with health effects, they indicate significant exposure. *Other sites of cancer* include larnyx (vocal cords), portions of digestive tract, and possibly the kidney. Asbestos's toxicity depends on fiber type (crocidolite > amosite > chrysotile), size (longer > shorter), shape (long, thin needle-like > curly), and solubility. Health effects depend on dose (exposure concentration and duration), smoking habits, and individual susceptibility. Prevent or maintain exposures at lowest feasible level.

Continue on next page

Section 6. Health Hazard Data, *continued*

Medical Conditions Aggravated by Long-Term Exposure: Long-term, high-level exposure may aggravate any chronic lung (asthma, emphysema, bronchitis) or heart condition. Target Organs: Respiratory system; possibly digestive system. Primary Entry Routes: Inhalation, ingestion, dermal contact. Acute Effects: Nose, throat, skin and eye irritation are possible with high exposure. Chronic Effects: Asbestosis, lung cancer, and mesothelioma typically develop decades (20 to 40 years) after exposure begins, but may occur sooner. FIRST AID *Emergency personnel should protect against asbestos exposure.* Eyes: Do not rub. Gently lift eyelids and flush with flooding amounts of water. Skin: Shower with water and soap. Wet contaminated clothing prior to removal and seal in a plastic bag for disposal as hazardous waste. If rash develops, consult physician. Inhalation: Remove to fresh air. Clean any fibers from nose and mouth. Encourage victim to cough, spit, and blow nose to remove fibers. Ingestion: Induce vomiting *only* if awake and alert. Consult a physician. **After first aid, consult medical care provider.** Note to Physicians: Asbestos diagnosis is based on chest X-ray with an abnormal ILO "B" reading (small irregular opacities), rales, restrictive pattern spirometry, adequate exposure history, and symptoms. Consider pneumovax, annual flu shot, and other supportive treatment as needed.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel. Cleanup personnel should protect against dust inhalation and skin or eye contact. Avoid dust generation, blowing, dry brushing, and dry mopping. Provide HEPA-filtered (high-efficiency particulate air) portable ventilation systems. Use wet cleaning methods or approved HEPA vacuum cleaning system to pick up spills. The techniques used must collect particulate without dispersing dust into air. Place waste in *properly labeled* dust-tight containers or sealed, heavy-gauge, impervious plastic bags for disposal. Follow applicable OSHA regulations (29 CFR 1910.120). Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a); Clean Air Act, Sec. 112]
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA Extremeley Hazardous Substance (40 CFR 355): Not listed
OSHA Designations
Listed as Air Contaminant (29 CFR 1910.1000, Table Z-1-A, Z-3)

Section 8. Special Protection Data

Note: *Do not substitute personal protective clothing or equipment for proper handling and engineering controls.* Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals not in excess of 2 f/cc (10 X PEL), use a half-mask air-purifying respirator, other than a disposable respirator, equipped with high-efficiency filters; not in excess of 10 f/cc (50 X PEL), a full facepiece air-purifying respirator equipped with high-efficiency filters; not in excess of 20 f/cc (100 X PEL), any powered air-purifying respirator equipped with high-efficiency filters or any supplied-air respirator operated in continuous flow mode; not in excess of 200 f/cc (1000 X PEL), a full facepiece supplied-air respirator operated in pressure-demand mode; greater than 200 f/cc (>1,000 X PEL) or unknown concentration, a full facepiece supplied-air respirator operated in pressure-demand mode and equipped with an auxillary positive-pressure self-contained breathing apparatus (29 CFR 1910.1001). *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Ventilation: Provide general and local exhaust ventilation and dust collection systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into work area by controlling it at its source.[103] Safety Stations: Make available in work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Never enter lunchroom facilities or leave workplace wearing clothing or equipment worn during workshift. Separate contaminated work clothes from street clothes. *If proper hygiene is not rigorously followed, family members can be exposed to asbestos fibers.* Place contaminated protective devices or work clothing in labeled, impermeable, and sealed containers or bags. Do not remove asbestos from clothing by blowing or shaking. Launder contaminated clothing before wearing. Inform laundering service of asbestos-contaminated clothing and of asbestos' potential harmful effects (29 CFR 1910.1001). Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using asbestos, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed (dust-tight) containers or heavy-gauge impervious plastic bags in a clean, secure area protected from physical damage. Do not open containers that can release asbestos dust without providing proper enclosure or control measure. Engineering Controls: Educate workers about asbestos's and asbestos-containing materials' hazards. Inform employees of asbestos standard (29 CFR 1910.1001). Exposure to asbestos, tremolite, anthophyllite, and actinolite in construction work is covered by 29 CFR 1926.58. ["OSHA is proposing an expanded requirement for a trained 'competent person' to ensure compliance with the standard on all construction operations involving asbestos, and requiring more stringent housekeeping to remove asbestos in general industry." (*Industrial Safety and Hygiene News*, 8/90).] Instruct employees in proper practices for handling asbestos-containing materials and correct use of protective equipment. Prevent or minimize asbestos exposure. Regulate areas where exposure in excess of the PEL is likely. Post warning signs in all regulated areas (see legend below). Work with asbestos only in a sufficient wet state to prevent emission of airborne fibers. Practice good personal hygiene and housekeeping procedures. Do not substitute personal protective equipment for proper handling and engineering controls. If exposures exceed the PEL, ensure employees wear appropriate protective clothing. Inhaling or ingesting asbestos fibers from contamined clothing or skin can be hazardous. Do not allow dusts and asbestos-containing wastes to accumulate. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Monitor work areas that expose employees to airborne concentrations at or above the action level (Sec. 2). Whenever production, process, control equipment, personnel, or work practices change, institute new monitoring. Other Precautions: Medical surveillance is required for all employees possibly exposed at or above the action level. Provide preplacement medical examination that includes complete medical and work history, complete physical examination that emphasizes respiratory and cardiovascular systems and digestive tract, the respiratory disease standardized questionnaire, a posterior-anterior 14" x 17" chest roentgenogram, and pulmonary function tests [FVC and FEV(1)]. Annual periodic medical examinations shall include all these elements and an abbreviated questionnaire. If it is 10+ years since first asbestos exposure, an individual should have a chest roentogram: every 5 years (ages 15 to 35), every 2 years (ages 35 to 45), every year (age 45+). Within 30 days of employment termination, an individual should receive a periodic medical examination with the elements listed above. Keep medical surveillance records for duration of employment, plus 30 years.

Transportation Data (49 CFR 172.101, .102)
DOT Shipping Name: Asbestos
DOT Hazard Class: ORM-C
ID No.: -
DOT Label: None
DOT Packaging Exceptions: 173.1090
DOT Packaging Requirements: 173.1090
Other Requirements: Stow and handle to avoid airborne particle
IMO Shipping Name: Asbestos, blue; asbestos, white
IMO Hazard Class: 9
ID No.: UN2212, UN2590
IMO Label: None
IMDG Packaging Group: II, III

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

MSDS Collection References: 2-4, 6, 12, 14, 20, 26, 32, 38, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138-140, 142, 143, 146, 148, 152, 153, 156-158
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: MJ Upfal, MD, MPH; Edited by: JR Stuart, MS

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 23

CADMIUM
(Revision C)
Issued: September 1977
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: CADMIUM

Description (Origin/Uses): Used in electroplating other metals; in dentistry; in alloys; in nickel-cadmium batteries; and in reactor control rods.

Other Designations: Cd; CAS No. 7440-43-9

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

Genium

HMIS
H 3 R 1
F 1 I 4
R 0 S 1
PPG* K 4 (Dust)
*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS, EXPOSURE LIMITS

Cadmium, CAS No. 7440-43-9, ca 100%

OSHA PEL
8-Hr TWA: 0.1 mg/m³ (Cd Fume)
Ceiling: 0.3 mg/m³ (Cd Fume)
8-Hr TWA: 0.2 mg/m³ (Cd Dust)
Ceiling: 0.6 mg/m³ (Cd Dust)

ACGIH NIC,* 1988-89
TLV-TWA: 0.01 mg/m³ (Cadmium and Compounds, as Cd)
ACGIH A2, Suspected Human Carcinogen

ACGIH TLVs, 1988-89
TLV-TWA: 0.05 mg/m³ (Cadmium Dusts and Salts, as Cd)
TLV-Ceiling: 0.05 mg/m³ (Cadmium Oxide Fume, as Cd)
TLV-TWA: 0.05 mg/m³ (Cadmium Oxide Production)

Toxicity Data**
Human, Inhalation, LC_{Lo}: 39 mg/m³ (20 Minutes)

*Notice of Intended Changes, Genium reference 116, p. 39.
**See NIOSH, *RTECS* (EU9800000), for additional data referring to reproductive, tumorigenic, and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 1413°F (767°C)
Melting Point: 610°F (321°C)
Vapor Pressure: 0.095 Torr at 610°F (321°C)
Molecular Weight: 112 Grams/Mole
Solubility in Water (%): Insoluble
Specific Gravity (H_2O = 1): 8.642

Appearance and Odor: A soft, blue white, malleable, lustrous metal that can be cut easily with a knife; odorless.
Comments: Cadmium has a significant vapor pressure of 0.000021 torr (corresponding to 0.12 mg/m³) at 315°F (157°C). Heating this metal without using correct engineering controls and/or personal protective equipment can result in overexposure.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method*	Autoignition Temperature*	LEL*	UEL*

Extinguishing Media: *Cadmium metal burns readily in air if it is heated. As with most metals, the reactivity/dust-cloud-explosion hazard increases as the cadmium metal becomes more finely divided. In fact, finely divided, powdered cadmium metal can be pyrophoric (it burns spontaneously in air without any source of ignition). Carbon dioxide, dry chemical, or sand are recommended extinguishing agents for cadmium fires. **Unusual Fire or Explosion Hazards:** Cadmium dust can explode during a fire. Massive cadmium metal does not present this potential explosion hazard; however, certain work operations such as grinding, welding, or cutting, can produce dust made of finely divided cadmium particles. **Warning:** Do not create a dust cloud of cadmium particles, especially during cutting, grinding, or welding operations. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Cadmium is stable in closed containers during routine operations. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Cadmium reacts dangerously with ammonium nitrate, hydrazoic acid, tellurium, and zinc (Genium ref. 84). **Conditions to Avoid:** Avoid all exposure to sources of ignition and to incompatible chemicals. **Hazardous Products of Decomposition:** When heated, which is likely during fires and work operations such as welding and machining, cadmium metal can decompose into cadmium metal fume and cadmium oxide fume.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: The ACGIH classifies cadmium and its compounds as suspected human carcinogens (group A2); the IARC lists them as probable human carcinogens (group 2B); and the NTP classifies them as anticipated human carcinogens (group b). **Summary of Risks:** Heating cadmium metal produces intensely irritating cadmium metal fume. The acute effects of its excessive inhalation, which include severe tracheobronchitis, pneumonitis, and pulmonary edema, are life threatening and are usually delayed for several hours; their mortality rate is about 20%. Nonfatal pneumonitis has resulted from exposure to 0.5 to 2.5 mg/m³; a fatality has been reported for five hours' exposure at 9 mg/m³ and for 1 hour's exposure at 40 to 50 mg/m³. There is no warning discomfort or immediate irritation from exposure to cadmium fume. Acute gastroenteritis and symptoms of metal fume fever are associated with even lower acute exposure. Symptoms of acute overexposure include excessive salivation, a dry, burning throat; headache; aching muscles; coughing; chest tightness and pain; nausea; chills, and fever chills; and fever. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, respiratory system, kidneys, and blood. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** See Summary of Risks, above. **Chronic Effects:** Long-term, chronic inhalation of cadmium dust, salts, or fume causes chronic cadmium poisoning characterized by a distinctive, nonhypertrophic emphysema with or without renal tubular injury, accompanied by the urinary excretion of a protein with a molecular weight

SECTION 6. HEALTH HAZARD INFORMATION, cont.

of 20,000 to 30,000. This protein is itself a sign of early but reversible chronic poisoning. (Possible chromosomal aberrations and decreased birth weight among babies of women exposed to cadmium have been noted.) **Danger:** Continued overexposure from inhalation causes irreversible renal tubular damage. Cancer, anemia, eosinophilia, anosmia, chronic rhinitis, yellowed teeth, and bone changes have been reported. Bone pain in the ribs, backbone, and femur is common; disorders of calcium metabolism develop; and kidney stones and pulmonary fibrosis have been described. **FIRST AID: Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. **Skin.** Rinse the affected area with flooding amounts of water, then wash it with soap and water. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion.** If a physician is not readily available, give the exposed person 2 to 3 glasses of water to drink and induce vomiting. A physician may administer a gastric lavage followed by saline catharsis. **Comments:** A comprehensive medical program is advised for those who work with cadmium or its compounds. This should include chest X rays and forced-vital-capacity tests. **Get medical help (in plant, paramedic, community) for all exposures.** Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to Physician:** Chelation therapy may be useful in treatment; calcium disodium edetate and pencillamine are recommended. Dimercaprol (BAL) is not recommended because of reported renal toxicity of the cadmium-BAL complex.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate ventilation. Cleanup procedures must not create dusty conditions. Pick up the spilled material using vacuuming, mopping, or wet-sweeping techniques. Cleanup personnel need protection against inhalation of dust and fume (see sect. 8). **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations. Concentrated solutions of cadmium waste can be precipitated with lime and collected by filtration. Effluent should be treated as needed to reduce the concentration of the cadmium to a level that is within regulatory compliance limits.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. D006 (40 CFR 261.24 [Characteristic of EP toxicity])
CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg), per the Clean Water Act (CWA), § 307 (a).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of a cadmium solution is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets, to prevent prolonged or repeated skin contact with this material. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems powerful enough to maintain airborne levels of cadmium below the OSHA PEL cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommnedations. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. Do not wear work clothes home. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale cadmium fume. Do not expose individuals with lung, liver, kidney, and blood ailments to cadmium until such exposure is approved by a physician.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store cadmium in closed containers in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage. Avoid storage situations where corrosion can occur. Keep powdered cadmium in closed containers; prevent the airborne dispersion of powdered cadmium. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, producing, and sampling operations to prevent static sparks. **Other Precautions:** The toxic effects of cadmium are influenced by the presence or absence of other elements such as zinc and selenium. If these materials are present in the workplace, careful evaluation of any exposure to cadmium is required to understand any contributing factors.

Hazardous Materials Table (49 CFR 172.101): Not Listed
Optional Hazardous Materials Table (49 CFR 172.102)

ID No. UN2570

IMO Shipping Name: Cadmium Compounds
IMO Hazard Class: 6.1
IMO Labels: Poison or Saint Andrew's Cross (X)*

*Harmful--Stow away from Foodstuffs (IMO Label, Materials of Class 6.1 Packaging Group III).

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

Prepared by PJ Igoe, BS
Industrial Hygiene Review: DJ Wilson, CIH
Medical Review: W Silverman, MD

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

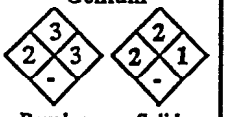
Sheet No. 758
Iron

Issued: 7/91

Section 1. Material Identification

Iron (Fe) Description: Occurs naturally as the second most abundant metal (~5%) in the earth's crust. Its commercial form usually contains some carbon, phosphorus, silica, sulfur, and manganese. It has four naturally occurring isotopes: 54, 56, 57 and 58, and six artificial ones: 52, 53, 55, 59, 60, and 61. Iron is purified by smelting ore with limestone and coke in blast furnaces (purity 91 to 92 %), or by continuous direct reduction of iron ore with limestone heated to 1699 °F (926 °C), melted at 3499 °F (1926 °C), and then reduced to iron at 2998 °F (1648 °C) with powdered coal (purity 99%). The powder form is obtained by treating ore or scrap metal with hydrochloric acid to give ferrous chloride solution, then filtrating, vacuum crystallizing, dehydrating, and reducing it at 1472 °F (800 °C) to metallic iron (briquettes or powder); or by thermal decomposition of iron carbonyl. Solid iron is used to alloy with carbon, manganese, chromium, nickel, and other elements to form steel. Its radioisotopes (^{55}Fe and ^{59}Fe) are used in biological tracer studies. The powder form is used in metallurgy products, magnets, high-frequency cores, and auto parts; and as a catalyst in ammonia synthesis.
Other Designations: CAS No. 7439-89-6, Ancor En 80/150,® Armco iron,® carbonyl iron, Loha,® Suy B-2.®
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Genium



R	1	HMIS	
I	2	H	2
S	1	F	2
K	1	R	1
		PPG*	

* Sec. 8

Cautions: Iron is moderately toxic by ingestion and inhalation of iron dusts and powder. The powder form is pyrophoric (ignites spontaneously upon exposure to air and other substances).

Section 2. Ingredients and Occupational Exposure Limits

Iron, ca 91 to 99%

1990 OSHA PEL	1990-91 ACGIH TLV	1990 NIOSH REL	1985-86 Toxicity Data†
8-hr TWA: 10 mg/m³*	TWA: 5 mg/m³*	5 mg/m³*	Rabbit, intraperitoneal, LD_{Lo}: 20 mg/kg; no toxic effect noted

*As iron oxide fumes.
† See NIOSH, *RTECS* (NO4565500), for additional toxicity data.

Section 3. Physical Data

Boiling Point: 4982 °F (2750 °C)
Melting Point: 2795 °F (1535 °C)
Vapor Pressure: 1 mm Hg at 3248 °F (1787 °C)
Electrical Resistivity: 9.71 μΩ/cm at 68 °F (20 °C)
Molecular Weight: 55.847
Density/Specific Gravity: 7.86 at 68 °F (20 °C)
Water Solubility: Insoluble

Appearance and Odor: Pure, solid iron is a silvery-white or gray, soft, ductile, malleable (can be rolled, hammered, or bent), slightly magnetic (becoming more so as it is alloyed; for example, steel) metal. It is available as ingots, wire, sheets, or powder. The powder form is black-gray.

Section 4. Fire and Explosion Data

Flash Point: None reported*	Autoignition Temperature: None reported*	LEL: None reported	UEL: None reported

Extinguishing Media: For small fire, use water spray, carbon dioxide (CO_2), or regular foam. For large fires, use water spray or regular foam. Apply cooling water spray to fires-exposed container sides until fire is well out. If possible with no risk, remove containers from area.
Unusual Fire or Explosion Hazards: Since finely divided iron powder is pyrophoric and ignites upon exposure to air at normal temperatures, fires and dust explosions can occur in ducts or separators used to remove the dust during grinding and polishing operations.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Fight fire from as far a distance as possible. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

*Although no flash point or autoignition temperature is reported, remember that the powder form is pyrophoric and can ignite spontaneously in air at room temperatures.

Section 5. Reactivity Data

Stability/Polymerization: Iron is stable in dry air, but readily oxidizes in moist air to form rust. Highly divided powder forms are very unstable and can ignite spontaneously in air.
Chemical Incompatibilities: Solid or powdered iron ignites or explodes on contact with acetaldehyde, ammonium peroxodisulfate, chloroformamidinium, chloric acid, ammonium nitrate, halogens, dinitrogen tetraoxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, and nitryl fluoride. Hot iron wire burns in chlorine gas and iron with water forms rust.
Conditions to Avoid: Avoid generation of iron dusts and contact with the materials listed above.
Hazardous Products of Decomposition: Thermal oxidative decomposition of iron can produce toxic iron oxide fumes.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA do not list iron as a carcinogen although the mining of one particular ore, hematite, may be associated with an increased risk of lung cancer in miners. No other iron ores are identified specifically as a carcinogen.
Summary of Risks: Occupational exposures usually result from dust or fume inhalation during mining, ore preparation, production, and refining of the metal and its alloys. Acute and chronic toxicity can occur. Although rare, occupational toxicity by ingestion has occurred. Its effects are the same as those by ingestion of large amounts of iron tablets.
Medical Conditions Aggravated by Long-Term Exposure: Chronic respiratory diseases.
Target Organs: Eyes, respiratory tract, liver, and pancreas.
Primary Entry Routes: Eyes, inhalation, and ingestion.
Acute Effects: Inhalation may be irritating to the respiratory tract. Eye contact may cause conjunctivitis (inflammation of the eye's lining), and deposition of iron particles can leave a "rust ring" or brownish stain on the cornea. Iron's acute toxicity results primarily from accidental or suicidal ingestions (e.g., overdose of iron-containing vitamin pills). Initially, the patient may have vomiting, abdominal pain, bloody diarrhea, hematemesis (vomiting blood), lethargy, and shock. After several hours, the patient may improve, but should be observed carefully, as toxicity may progress to development of profound shock, severe acidosis (increased acidity in blood), cyanosis (bluish skin discoloration), and fever. Two to four days after exposure, liver damage may occur. Within several weeks after exposure, in several rare cases, gastrointestinal fibrosis (scarring) has occurred with obstruction of the digestive tract. Iron overdose may be fatal.
Chronic Effects: Chronic inhalation can produce mottling (spotting) of lungs (siderosis). This condition is often without symptoms and has been referred to as "benign radiopaque pneumoconiosis." Ingestion of greater than 50 to 100 mg of iron per day may result in pathological iron deposition in body tissues. Symptoms include fibrosis (scarring) of the pancreas, diabetes mellitus, and liver cirrhosis. Repeated iron ingestion can produce cardiac toxicity.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting. Consult poison control center.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Management of iron poisoning by ingestion is complex and beyond this MSDS's scope. Consult a medical toxicologist.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate hazard area, deny entry, and stay upwind. Shut off all ignition sources--no flares, smoking, or flames in hazard area. Avoid dust generation by cleaning small spills with a damp mop. Since finely divided iron powder is explosive, take special care during cleanup. For large spills, flush material with a stream of water and dike for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Listed (as iron oxide fumes) as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator.
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent any skin contact.
Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in a cool, dry, well-ventilated area away from flammable gases or liquids, oxidizing materials, or organic peroxides (Sec. 5).
Engineering Controls: Avoid dust inhalation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Regularly service the ducting at grinding and polishing machines and finishing belts to maintain efficiency of exhaust ventilation and prevent explosion. Remote control operations of machinery is advisable when at all possible.

Transportation Data (49 CFR 172.101)
DOT Shipping Name: Iron mass *or* sponge, *not properly oxidized*
DOT Hazard Class: Flammable solid
ID No.: NA1383
DOT Label: Flammable solid
DOT Packaging Exceptions: None
DOT Packaging Requirements: 173.174

MSDS Collection **References:** 26, 73, 103, 124, 126, 127, 132, 136, 138, 139, 143, 146, 148, 149, 159
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 713
Lead (Inorganic)

Issued: 8/90

Section 1. Material Identification

Lead (Inorganic) (Pb) Description: Exists widely throughout the world in a number of ores. Its main commercial source is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, drossing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (brass, pipes, caulking); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a constuction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.
Other Designations: CAS No. 7439-92-1, lead oxide; lead salts, inorganic; metallic lead; plumbum.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R	0
I	4
S	-
K	0

Genium

HMIS
H 3
F 1
R 0
PPG*

* Sec. 8

Cautions: *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affected organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure.

Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

1989 OSHA PELs (Lead, Inorganic compounds)
8-hr TWA: 50 µg/m³
Action Level TWA*: 30 µg/m³

29 CFR 1910.1025 Lead Standard
Blood Lead Level: 40 µg/100 g

1989-90 ACGIH TLV (Lead, Inorganic, fumes and dusts)
TLV-TWA: 150 µg/m³

1988 NIOSH REL
10-hr TWA: <100 µg/m³

1985-86 Toxicity Data†
Human, inhalation, TC_{Lo}: 10 µg/m³ affects gastrointestinal tract and liver
Human, oral, TD_{Lo}: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, TD_{Lo}: 790 mg/kg affects multigeneration reproduction

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *RTECS* (OF7525000), for additional mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 3164 °F (1740 °C)
Melting Point: 621.3 °F (327.4 °C)
Vapor Pressure: 1.77 mm Hg at 1832 °F (1000 °C)
Viscosity: 3.2 cp at 621.3 °F (327.4 °C)
Molecular Weight: 207.20
Specific Gravity (20 °C/4 °C): 11.34
Water Solubility: Relatively insoluble in hot or cold water*
Appearance and Odor: Bluish-white, silvery, gray, very soft metal.

* Lead dissolves more easily at a low pH.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Unusual Fire or Explosion Hazards: Flammable and moderately explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is incompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
Conditions to Avoid: Rubber gloves containing lead may ignite in nitric acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

Section 6. Health Hazard Data

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
Summary of Risks: Lead is a potent, systemic poison that affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system. The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead can be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
Medical Conditions Aggravated by Exposure: Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood presssure can aggravate cardiovascular disease.

Continue on next page

Section 6. Health Hazard Data, *continued*

Target Organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.
Chronic Effects: Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival (gum) tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irritability, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often, ankle extensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if any, symptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage or developmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by severe headache, convulsions, coma, delirium, and possibly death.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Consult a physician if any health complaints develop.
Inhalation: Remove exposed person to fresh air and support breathing as needed. Consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with Ipecac syrup. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic anemia and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and gingival lead line. Use Ca-EDTA to treat poison, but *never* chelate prophylactically. Consult an occupational physician or toxicologist.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dusts or fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formation of dust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled material into closed containers for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33, Appendix II—EP Toxicity Test Procedures)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.
Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially washing hands before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all incompatible materials, direct sunlight, and heat and ignition sources.
Engineering Controls: Educate worker about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid inhalation of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate and launder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures. For a variety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.
Other Precautions: Provide preplacement and periodic medical examinations which emphasize blood, nervous system, gastrointestinal tract, and kidneys, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, allergies, smoking history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for medical surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of employment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead absorption level. Maintain worker PbBs at or below 40 µg/100 g of whole blood. To minimize adverse reproductive health effects to parents and developing fetus, maintain the PbBs of workers intending to have children below 30 µg/100 g. Elevated PbBs increase your risk of disease, and the longer you have elevated PbBs, the greater your chance of substantial permanent damage.

Transportation Data (49 CFR 172.102)
IMO Shipping Name: Lead compounds, soluble, n.o.s.
IMO Hazard Class: 6.1
ID No.: UN2291
IMO Label: St. Andrews Cross (X, Stow away from foodstuffs)
IMDG Packaging Group: III

MSDS Collection References: 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: MJ Upfal, MD, MPH; Edited by: JR Stuart, MS

Attachment C
Emergency Procedures for Exposure to Hazardous Materials/Waste

ATTACHMENT C

EMERGENCY PROCEDURES FOR EXPOSURE TO HAZARDOUS MATERIALS/WASTE

1. Call ambulance or transport individual to hospital/clinic immediately. Don't forget to take the HASP with you; it contains information on the contaminants expected to be found on site and will assist the physician in his/her assessment of the exposure.

2. Fill in Potential Exposure Report, answering each of the questions to the best of your ability.

3. Contact our physician(s) at EMR as soon as possible. The procedure is as follows:

    a. **Call EMR at 1-800-229-3674!**

    b. Ask to speak with:

        Dr. David L. Barnes;
        Dr. Elaine Theriault; or
        Ms. T.J. Wolff, R.N.

Note: During nonbusiness hours (after 6 p.m.) call 1-800-229-3674 and follow directions for paging the aforementioned individuals.

4. Once in contact with any of these individuals, explain what has happen (they will review the information on the form with you and may ask you to fax the form to them, if possible), and allow either of them to speak with the attending physician.

5. When asked about payment (and they will ask), inform the Hospital/Clinic/Physician that this is a "work related injury" and have them contact the Benefits Coordinator at (412) 269-2744. Have invoices sent to:

    Michael Baker Jr. Inc.
    Attn: Benefits Coordinator
    Airport Office Park, Bldg. 3
    Coraopolis, PA 15108

6. Contact the Project Manager and the Project Health and Safety Officer as soon as it is feasible, but wait no longer than 24 hours.

Baker
Baker Environmental, Inc

POTENTIAL EXPOSURE REPORT

Name: _____ Date of Exposure: _____

Social Security No.: _____ Age: _____ Sex: _____

I. Exposing Agent

Name of Product or Chemicals (if known) _____

_____

Characteristics (if the name is not known)

Solid Liquid Gas Fume Mist Vapor

II. Dose Determinants

What was individual doing? _____

How long did individual work in area before signs/symptoms developed?

_____

Was protective gear being used? If yes, what was the PPE?

_____

Was there skin contact? _____

Was the exposing agent inhaled? _____

Were other persons exposed? If yes, did they experience symptoms?

_____

III. Signs and Symptoms (check off appropriate symptoms)

Immediately with Exposure:

- ☐ Burning of eyes, nose, or throat
- ☐ Tearing
- ☐ Headache
- ☐ Cough
- ☐ Shortness of breath
- ☐ Delirium
- ☐ Chest tightness/pressure
- ☐ Nausea/vomiting
- ☐ Dizziness
- ☐ Weakness
- ☐ Heat flashes
- ☐ Other _____

Delayed Symptoms:

- ☐ Weakness
- ☐ Nausea/vomiting
- ☐ Shortness of breath
- ☐ Cough
- ☐ Loss of appetite
- ☐ Abdominal pain
- ☐ Headache
- ☐ Numbness/tingling
- ☐ Other _____

Baker
Baker Environmental, Inc

POTENTIAL EXPOSURE REPORT

IV. Present Status of Symptoms (check off appropriate symptoms)

- ☐ Burning of eyes, nose, or throat
- ☐ Tearing
- ☐ Headache
- ☐ Cough
- ☐ Shortness of breath
- ☐ Chest tightness/pressure
- ☐ Cyanosis (bluish skin color)
- ☐ Nausea/vomiting
- ☐ Dizziness
- ☐ Weakness
- ☐ Loss of appetite
- ☐ Abdominal pain
- ☐ Numbness/tingling
- ☐ Other _____

Have symptoms (please check off appropriate response and give duration of symptoms):

Improved _____ Worsened _____ Remain Unchanged _____

V. Treatment of Symptoms (check off appropriate response)

None _____ Self-medicated _____ Physician treated _____

VI. Name _____
(Attending physician)

VII. Hospital/Clinic _____

Source: EMR, Inc.