327 0 File: 541.460.000n
C.G.

THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 327

File:
C.G. 541.460.C
327

327 1

U.S. Army Corps of Engineers
Huntsville Center
Mandatory Center of Expertise & Design Center
Ordnance and Explosive Waste

FINAL

Work Plan to Conduct Site Characterization in Support of an Engineering Evaluation/Cost Analysis at Operable Unit 1 Defense Distribution Depot Memphis Memphis, Tennessee

Contract No. DACA87 - 95 - D - 0018
Task Order 19

Prepared by

PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia

July 1998
732283

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

U.S. Army Corps of Engineers
Huntsville Center
Mandatory Center of Expertise & Design Center
Ordnance and Explosive Waste

Addendum to Work Plan to Conduct Site Characterization in Support of an Engineering Evaluation/Cost Analysis at Operable Unit 1 Defense Distribution Depot Memphis Memphis, Tennessee

Contract No. DACA87 - 95 - D - 0018
Task Order 19

Prepared by

PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia

July 1998

732283

PARSONS

ADDENDUM TO WORK PLAN TO CONDUCT SITE CHARACTERIZATION IN SUPPORT OF AN ENGINEERING EVALUATION/COST ANALYSIS AT OPERABLE UNIT 1 DEFENSE DISTRIBUTION DEPOT MEMPHIS MEMPHIS, TENNESSEE

Contract No. DACA87 - 95 - D - 0018
Task Order 19

Prepared for

U. S. Army Corps of Engineers
Huntsville Center

Prepared by

PARSONS ENGINEERING SCIENCE, INC.
5390 Triangle Parkway, Suite 100
Norcross, Georgia 30092

July 1998

WORK PLAN ADDENDUM

The purpose of this addendum is to summarize the results of the non-intrusive geophysical investigation performed at Dunn Field and to recommend locations for the six borings/monitoring wells to be installed at the site.

1.0 GEOPHYSICAL INVESTIGATION

A non-intrusive geophysical investigation was performed at Dunn Field using the procedures outlined in the Site Specific Geophysical Investigation Plan (Section 3 of the Work Plan). Maps showing results of the EM-31 and magnetometer surveys were previously provided to CEHNC overlain by a Dunn Field drawing provided to Parsons ES by CEHNC. The Dunn Field drawing is titled "Location of Materials Buried in Dunn Field" and was prepared in 1956 by the office of the post engineer and updated several times with the last being in January 1984. Most of the areas outlined by the 1956 drawing as trenches or pits were found to have geophysical anomalies associated with them (indicating metallic items or disturbed earth in the subsurface). The geophysical survey also shows several other anomalous areas not previously indicated either in the Archives Search Report (ASR, 1995) or on the 1956 drawing to have been trench or pit areas.

2.0 AREAL PHOTOGRAPHS

A series of digitized aerial photographs were provided to Parsons ES by the U.S. Army Topographic Engineering Center. Photographs taken in the years 1945, 1946, 1958, 1959, 1963, and 1973 were rectified (assigned state-plane coordinates) and overlain by the 1956 Dunn Field drawing and contours from the 1998 magnetometer and EM-31 geophysical surveys. The overlays are presented as Plates 1 through 12.

3.0 AREAS OF CONCERN

Four areas, A-1, A-2, B-1, and B-2 were determined to be areas of concern with respect to chemical warfare agents for the Dunn Field investigation (see Figure 4.1 in Work Plan). These areas are shown in Figures 1 through 3 (EM-31 survey maps of Dunn Field) and on all of the plates.

Area A-1: A trench 30 feet long, 7 feet wide, and 12 feet deep (USACE, 1995a, Section 5.2) in Area A in Dunn Field was reportedly used to dispose of twenty-nine mustard-filled German bombs in July 1946.

Area A-2: A second possible location of the German bomb burial was in a slurry pit identified as a series of three burial pits reported to contain chlorinated lime.

Area B-1: Chemical Agent Identification Sets (CAIS) were reportedly disposed and buried in Dunn Field in the years 1952-1953. The location of their disposal was determined through the ASR to be an approximately 400 foot long trench located in the eastern half of Area B.

Area B-2: A second possible location described in the ASR for the CAIS burial is a small pit located a few hundred feet northwest of the long trench.

A full description of these areas and the items thought to be buried is presented in Section 2 of the Work Plan.

4.0 OVERLAY/HISTORICAL DATA ANALYSIS

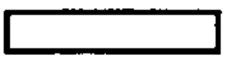
An analysis of the overlay maps of the aerial photos, 1956 Dunn Field drawing, 1998 magnetometer and EM-31 contours (Plates 1-12) and available historical data (from the ASR) indicate the following with respect to the areas of concern discussed above:

4.1 Area A-1: Possible Site for Mustard-Filled German Bombs

4.1.1 Cloth Drawing

Area A-1 was identified in the ASR as the location of the German Mustard Bomb disposal area. An old reproducible linen cloth drawing of the Dunn Road area was found during the archives search and in an erased area of the drawing, the faint remnants of the words "MUSTARD GAS" and the outline of a trench were seen. By varying the tone and contrast levels of a blue-print machine, the erased area became fairly readable as:

TRENCH 100' LONG 10' DEEP



MUSTARD GAS

4.1.2 1956 Drawing

The 1956 drawing of Dunn Field does not show any features in the area suggested by the ASR to be the disposal location.

4.1.3 Aerial Photo

The aerial photograph interpretation provided by TEC does not indicate any disturbance of ground in the area thought to be the trench location for any of the photographs examined (including years 1945, 1946, 1953, 1957, 1958, 1959, 1963, 1973, and 1990).

4.1.4 Geophysics

The geophysical results indicate an anomalous area possibly representing a trench or pit near the location suggested in the ASR.

4.2 Area A-2: Alternate Possible Site for Mustard-Filled German Bombs

4.2.1 1956 Drawing

The 1956 drawing of Dunn Field shows the location of the three trenches in approximately the same location as those shown in the ASR for Area A-2.

4.2.2 Aerial Photo

The TEC aerial photograph interpretation of the year 1946 shows a possible excavation near the trench locations shown in the ASR for Area A-2. The photo was taken in February, however, and the bombs were reportedly not buried until July.

4.2.3 Geophysics

The geophysical results indicate an anomalous area possibly representing a trench near the location suggested in the ASR. The anomalous area is slightly east of the location shown in the 1956 drawing and southeast of the surface feature identified as a trench on the 1946 aerial photo.

4.3 Area B-1: Possible Site for Chemical Agent Identification Sets Burial

4.3.1 1956 Drawing

The 1956 drawing of Dunn Field shows a trench in approximately the same location as is shown in the ASR for Area B-1. This area, however, is shown on the 1956 site drawing as "550 plane crash residue - military clothing, asphalt roofing, rock (roofing rock), wood, roof trusses, cardboard, plastic, misc. metal, sprinkler pipe, elect. conduit" buried in January 1984 (the map was revised among other times in September of 1984.)

4.3.2 Aerial Photo

The TEC aerial photograph interpretation of the years 1953, 1958, and 1959 show several possible small trenches in the northeast area of Dunn Field. Given their smaller size, these trenches are more likely associated with the other small trenches shown in the 1956 drawing and the ASR report than with the 400 foot long trench in which the CAIS kits were reportedly buried. A large ground scar of approximately the correct size, however, is apparent in the 1990 aerial photograph in the same location as that shown in the updated 1956 site drawing.

4.3.3 Geophysics

The geophysical results indicate a long anomaly in the same location as the trench shown in both the updated 1956 drawing, the ASR report, and the 1990 aerial photograph.

4.4 Area B-2: Alternate Possible Site for Chemical Agent Identification Sets Burial

4.4.1 1956 Drawing

The 1956 drawing of Dunn Field shows a location for the burial of CAIS kits in approximately the same location (but a few hundred feet east of) the one shown in the ASR for Area B-2. The drawing indicates that "6 sets of 1" x 9" Mustard and Lewisite" were buried in the trench on 22 July, 1955.

4.4.2 Aerial Photo

The TEC aerial photograph interpretation of the years 1958, 1959 and 1963 show several possible small trenches and disturbed ground in the northeast area of Dunn Field. One of these trenches or disturbed areas may be associated with the Area B-2 trench.

4.4.3 Geophysics

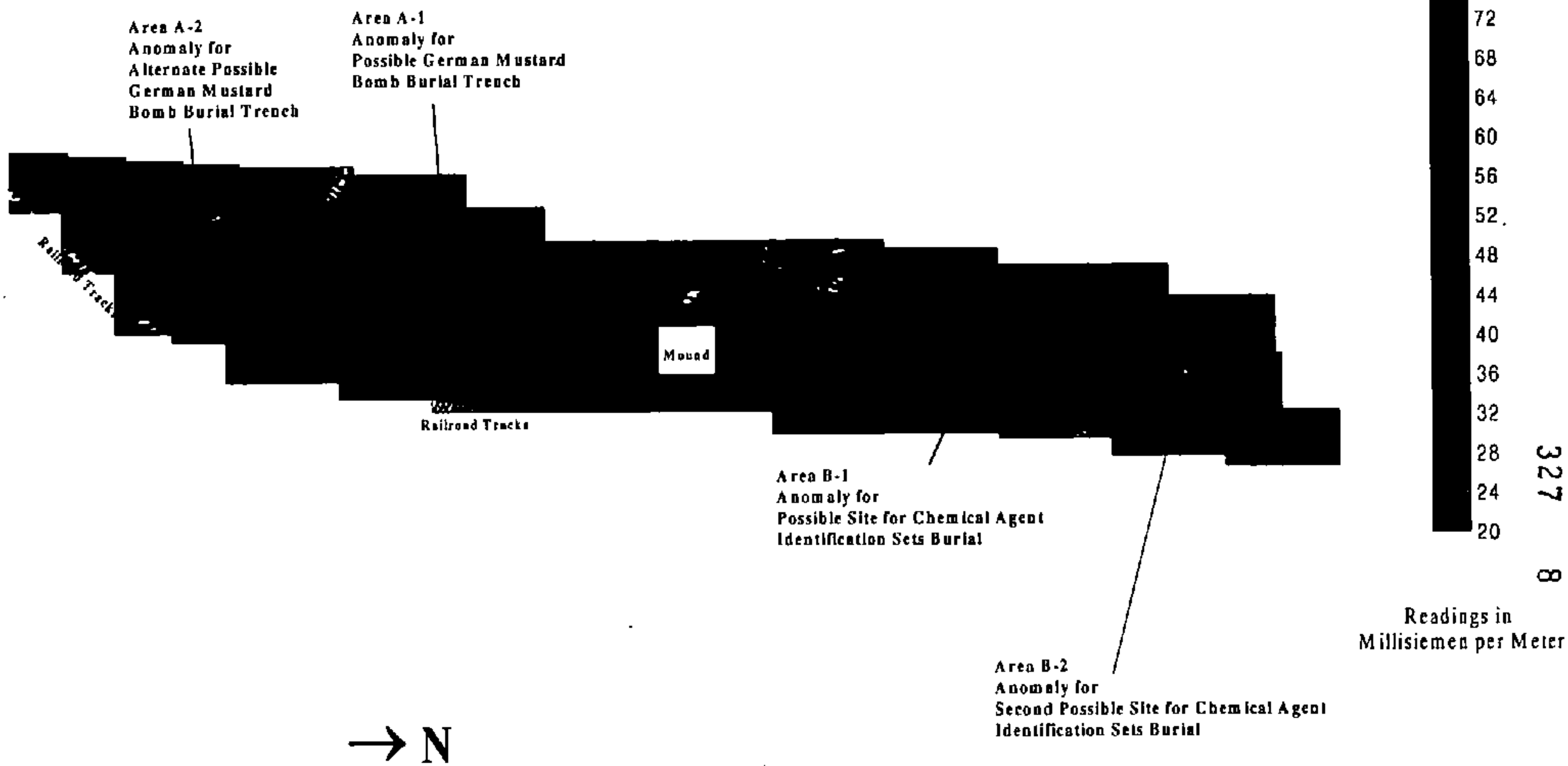
There are several small geophysical anomalies near the location of Area B-2 shown on the 1956 site drawing. One of these may be associated with the CAIS kit burial trench.

4.5 SELECTION OF BORING/WELL LOCATIONS

Proposed boring/well locations are shown on Plate 13. These locations were selected to collect groundwater downgradient from areas of concern A-1, A-2 and B-2 while remaining clear of other geophysically anomalous areas which may represent unknown burials. Area B-1 is not considered suspect as all available information suggests that the trench in this area was created in 1986. Upgradient groundwater data will be collected by sampling existing monitoring wells MW-9 and MW-14 (see Figure 4.1 of Work Plan).

Figure 1
EM-31 Terrain Conductivity Survey
Defense Distribution Depot Memphis
Memphis, Tennessee

Black and white
areas indicate
off scale readings.



327 8

Figure 2
South Dunn Field
EM-31 Terrain Conductivity Survey
Defense Distribution Depot Memphis
Memphis, Tennessee

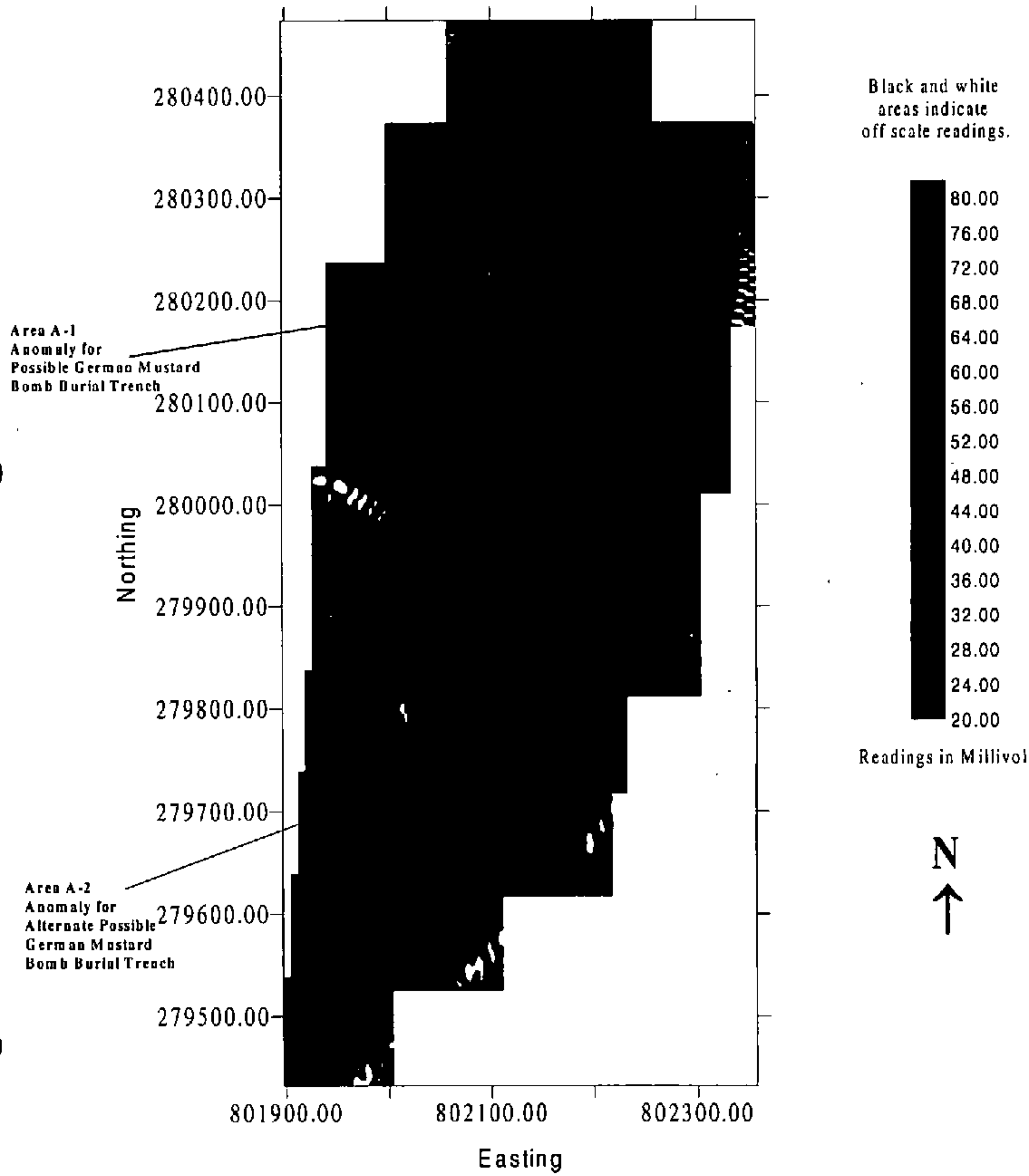


Figure 3
North Dunn Field
EM-31 Terrain Conductivity Survey
Defense Distribution Depot Memphis
Memphis, Tennessee

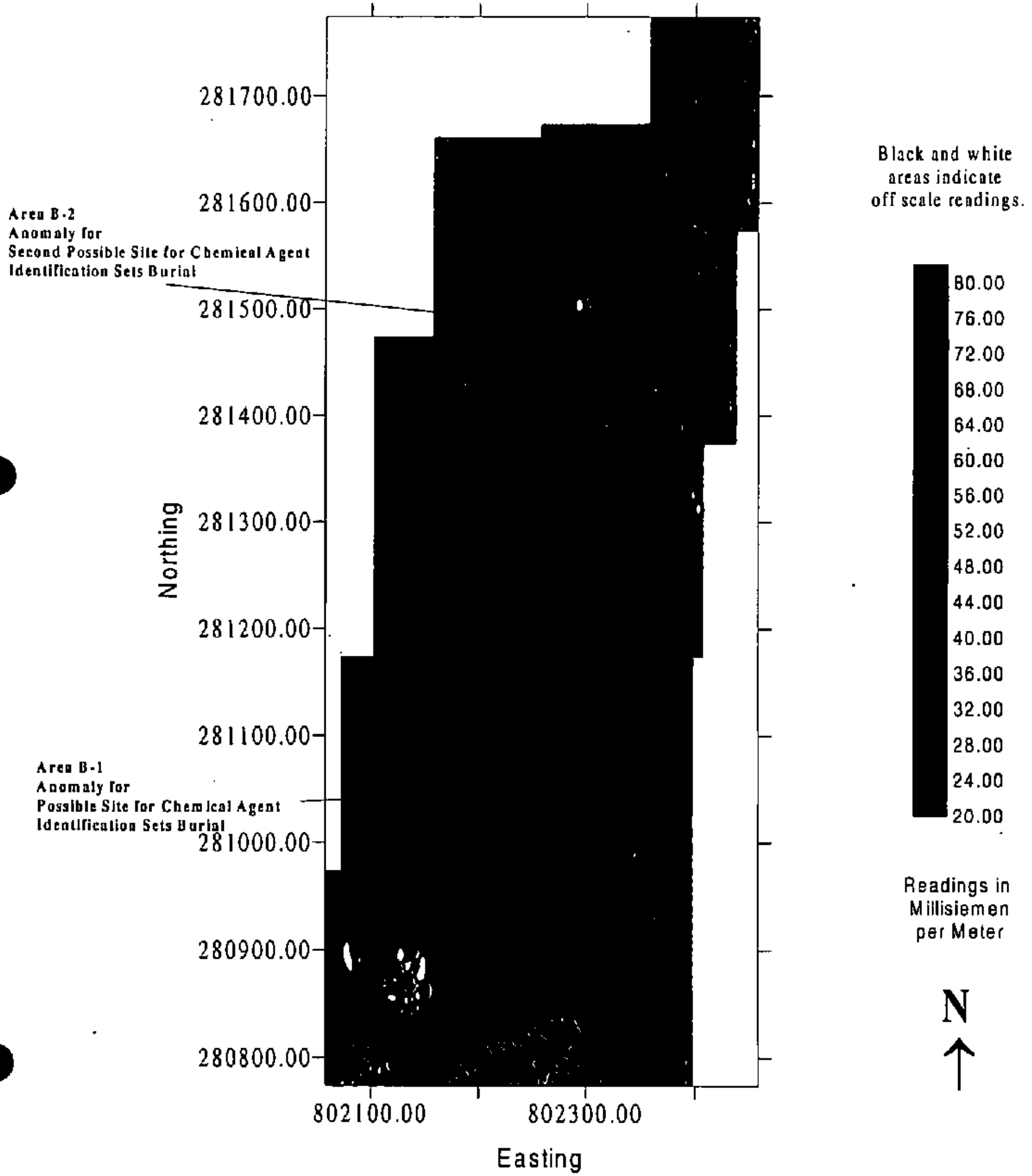
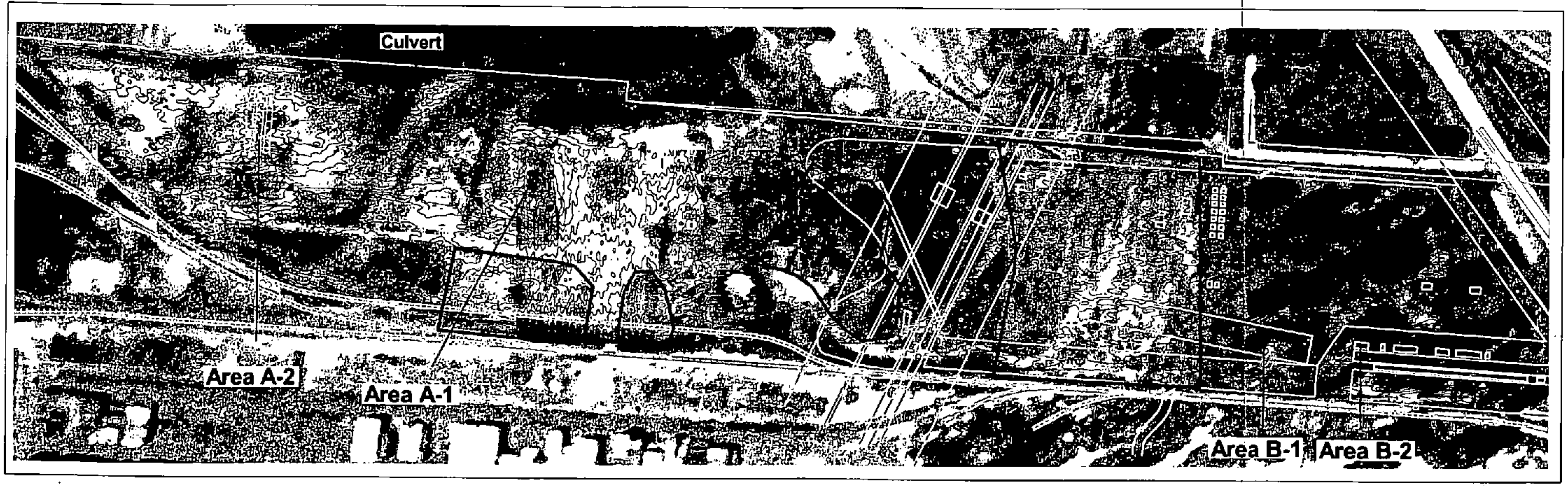


PLATE 1
DUNN FIELD
1945 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 EM-31 Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



200 0 200 400 Feet

N

LEGEND

Disturbed Ground

Ditch

80

60

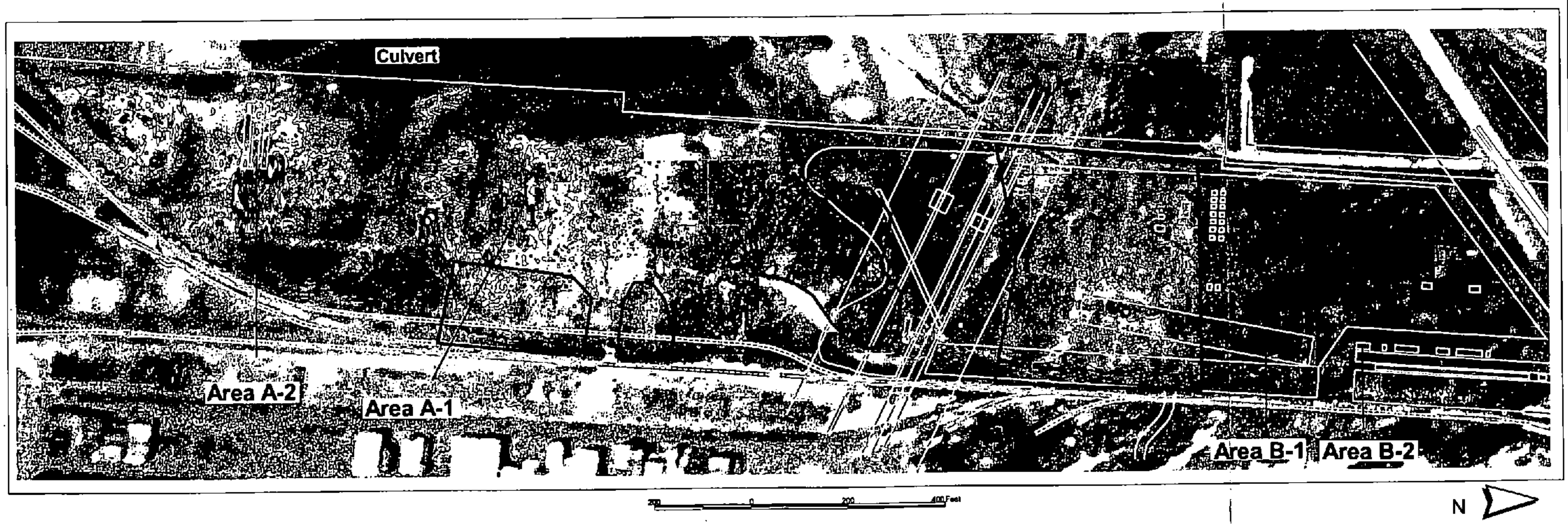
40

20

EM-31 Readings in Millisiemen per meter

PLATE 2
DUNN FIELD
1945 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 Magnetometer Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



LEGEND

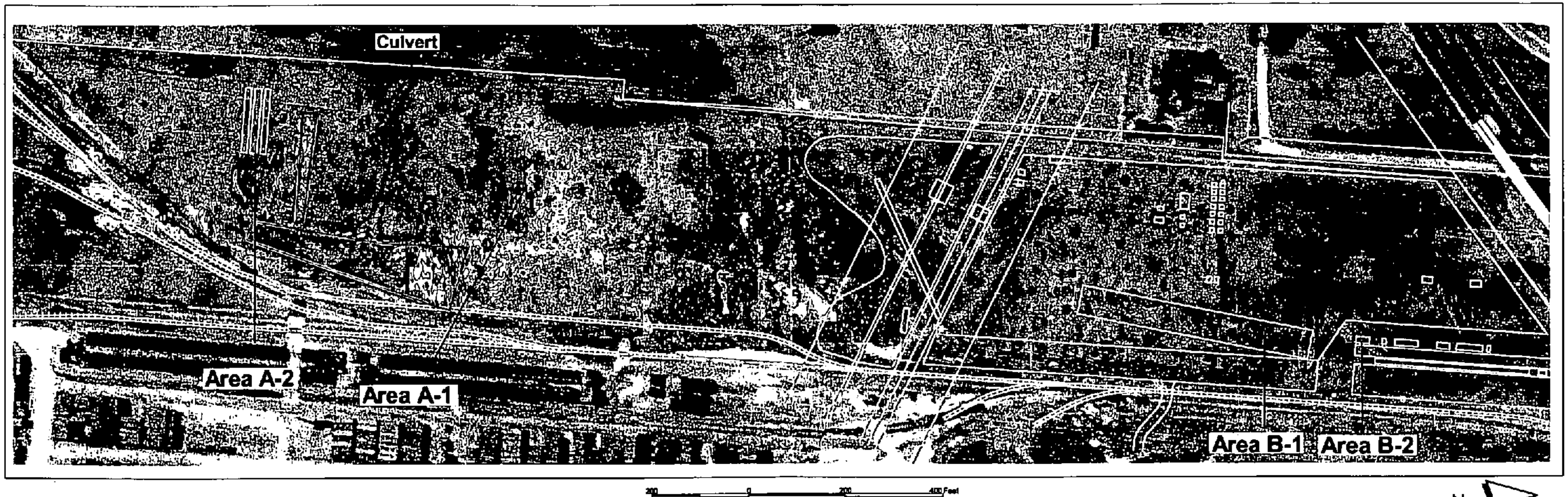
- Disturbed Ground
- Ditch

— 200
— 100
— 0
— -100
— -200

Magnetometer Readings in NanoTesla

PLATE 3
DUNN FIELD
1946 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 EM-31 Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



LEGEND

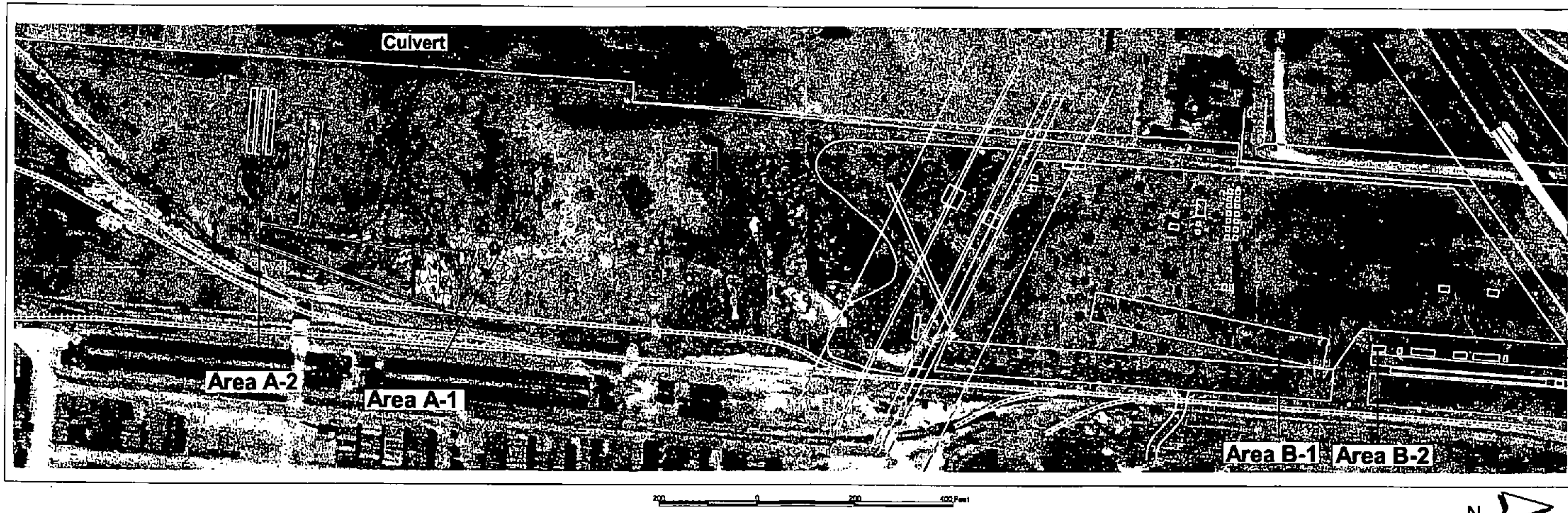
Excavated

— 80
— 60
— 40
— 20

EM-31 Readings in Millisiemen per meter

PLATE 4
DUNN FIELD
1946 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 Magnetometer Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



LEGEND

Excavated

Magnetometer Readings in NanoTesla

- 200
- 100
- 0
- -100
- -200

PLATE 5
DUNN FIELD
1958 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 EM-31 Survey

Defense Distribution Depot Memphis
Memphis, Tennessee

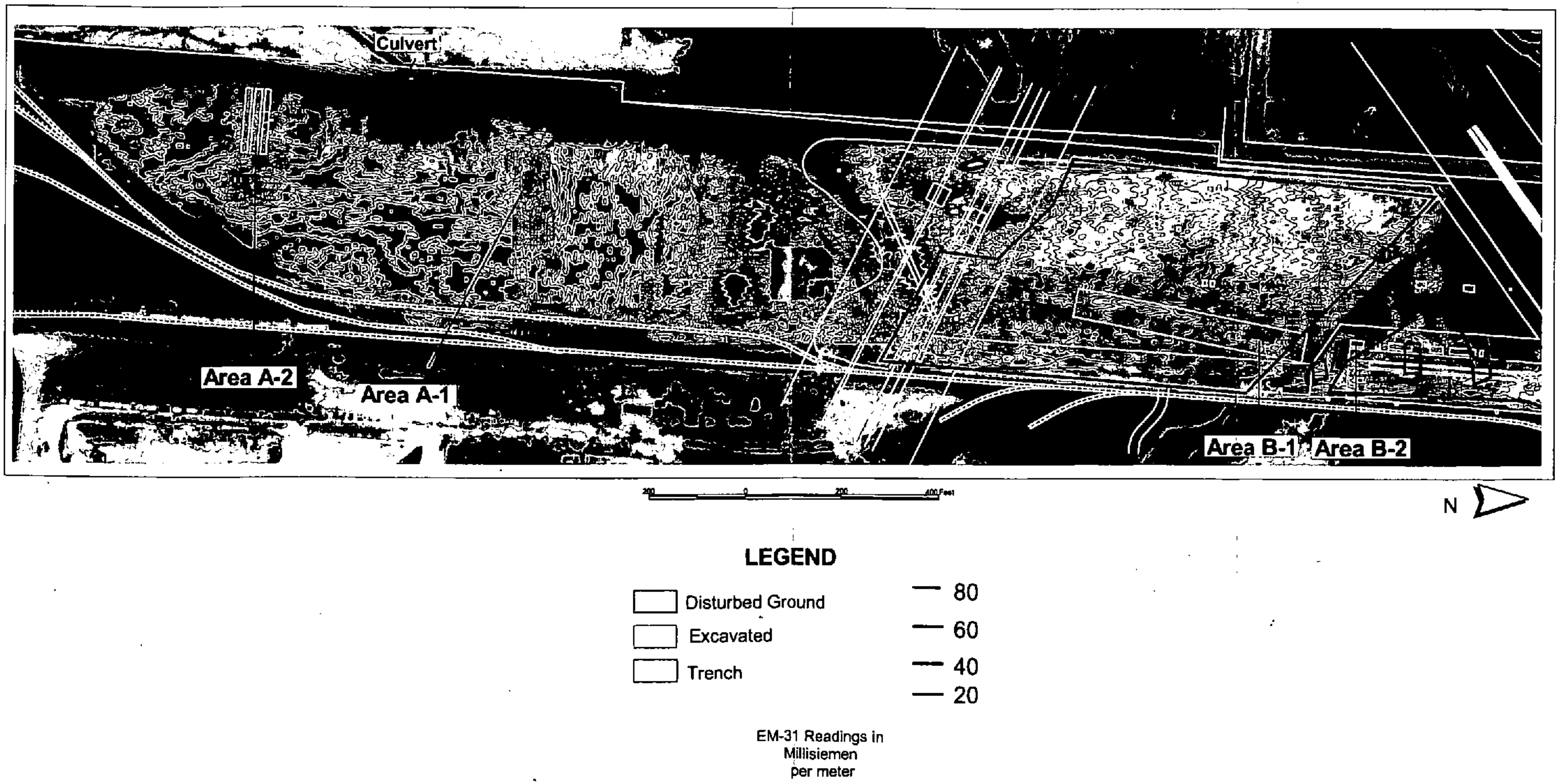


PLATE 6
DUNN FIELD
1958 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 Magnetometer Survey

Defense Distribution Depot Memphis
Memphis, Tennessee

LEGEND

- Disturbed Ground
- Excavated
- Trench

Magnetometer Readings in NanoTesla

- 200
- 100
- 0
- -100
- -200

PLATE 7
DUNN FIELD
1959 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 EM-31 Survey

Defense Distribution Depot Memphis
Memphis, Tennessee

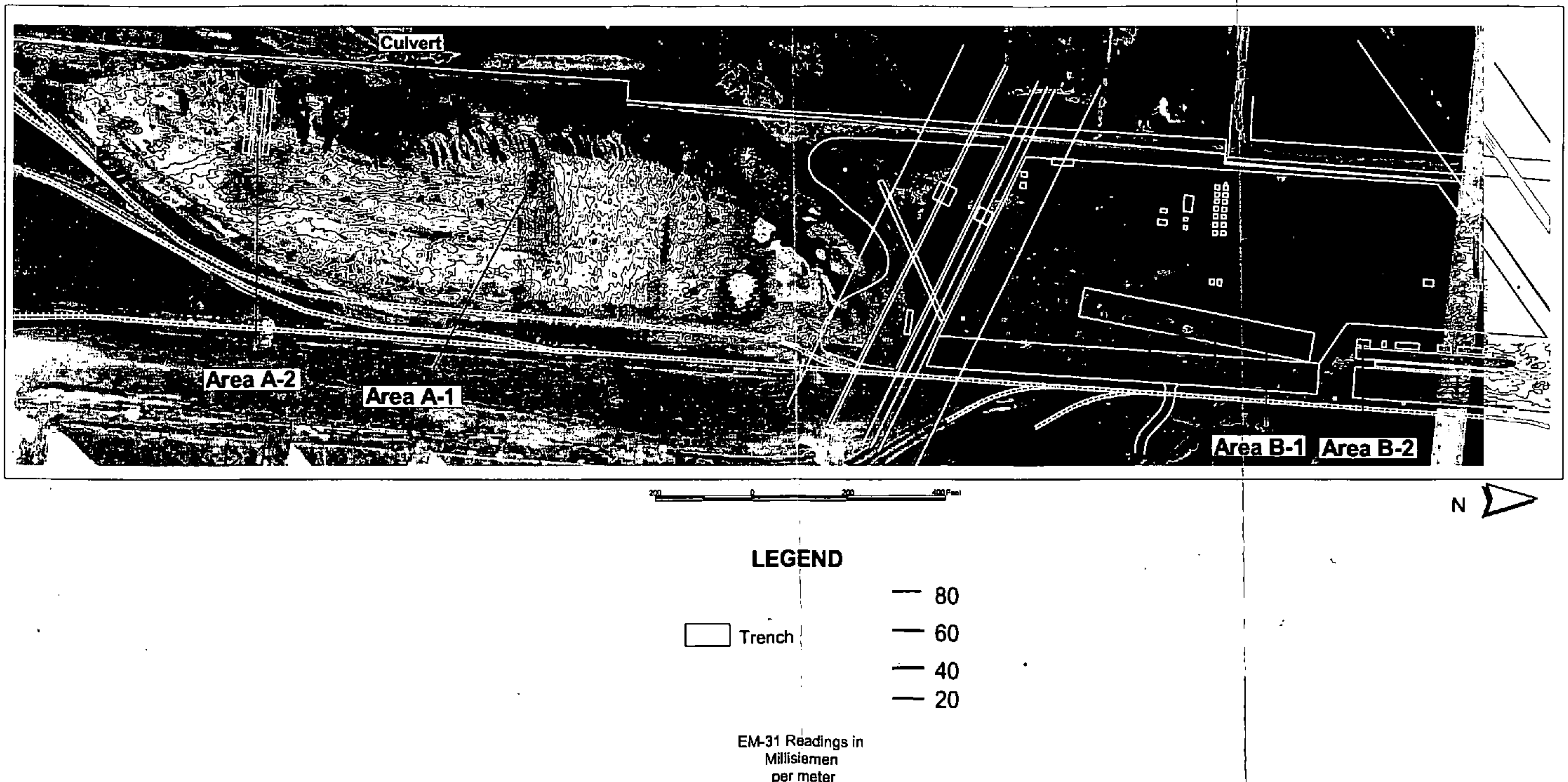


PLATE 8
DUNN FIELD
1959 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 Magnetometer Survey

Defense Distribution Depot Memphis
Memphis, Tennessee

LEGEND

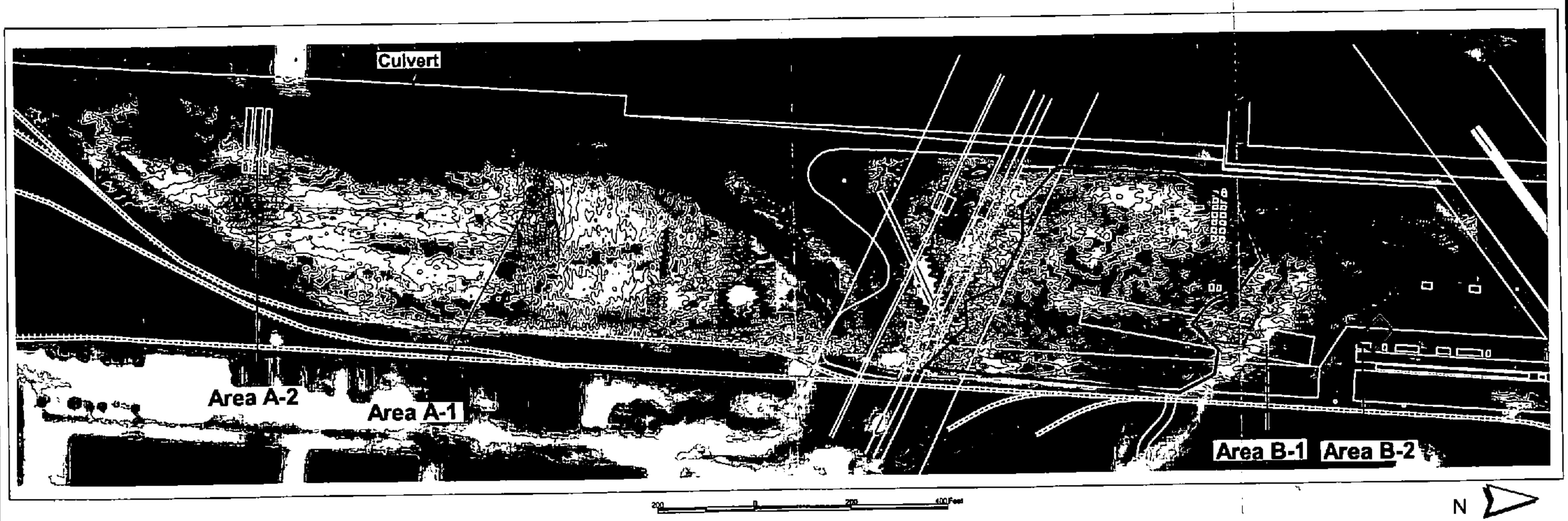
Trench

— 200
— 100
— 0
— -100
— -200

Magnetometer Readings in NanoTesla

PLATE 9
DUNN FIELD
1963 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 EM-31 Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



LEGEND

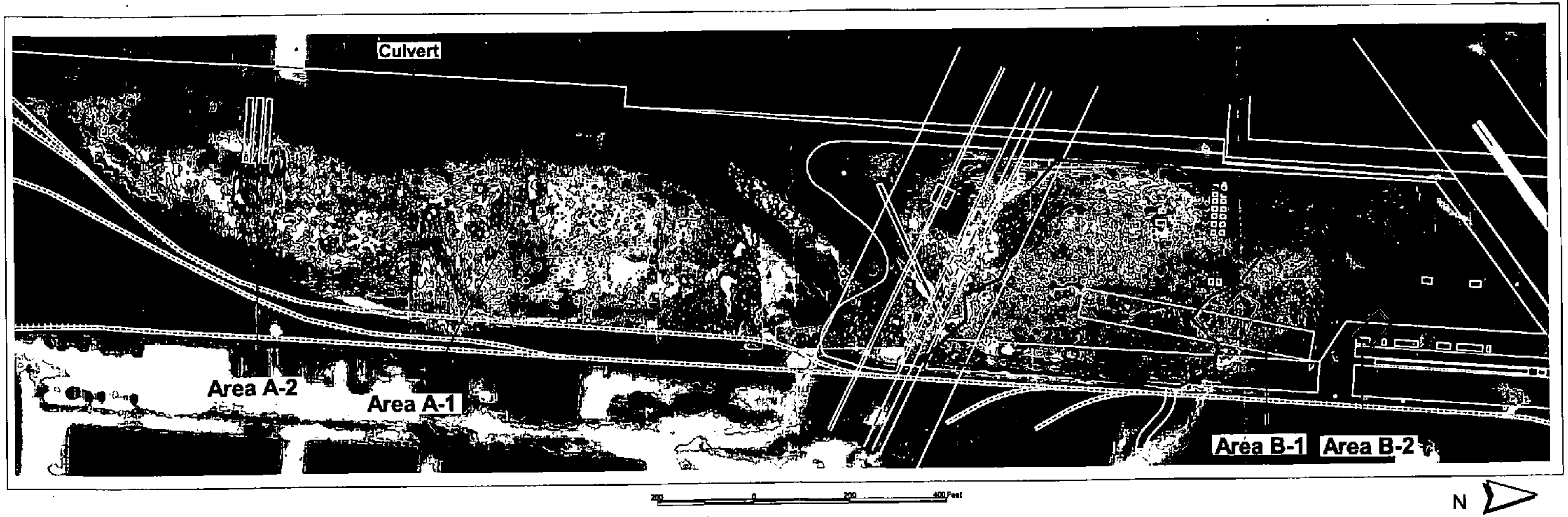
Disturbed Ground
Excavated
Trench

— 80
— 60
— 40
— 20

EM-31 Readings in Millisiemen per meter

PLATE 10
DUNN FIELD
1963 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 Magnetometer Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



LEGEND

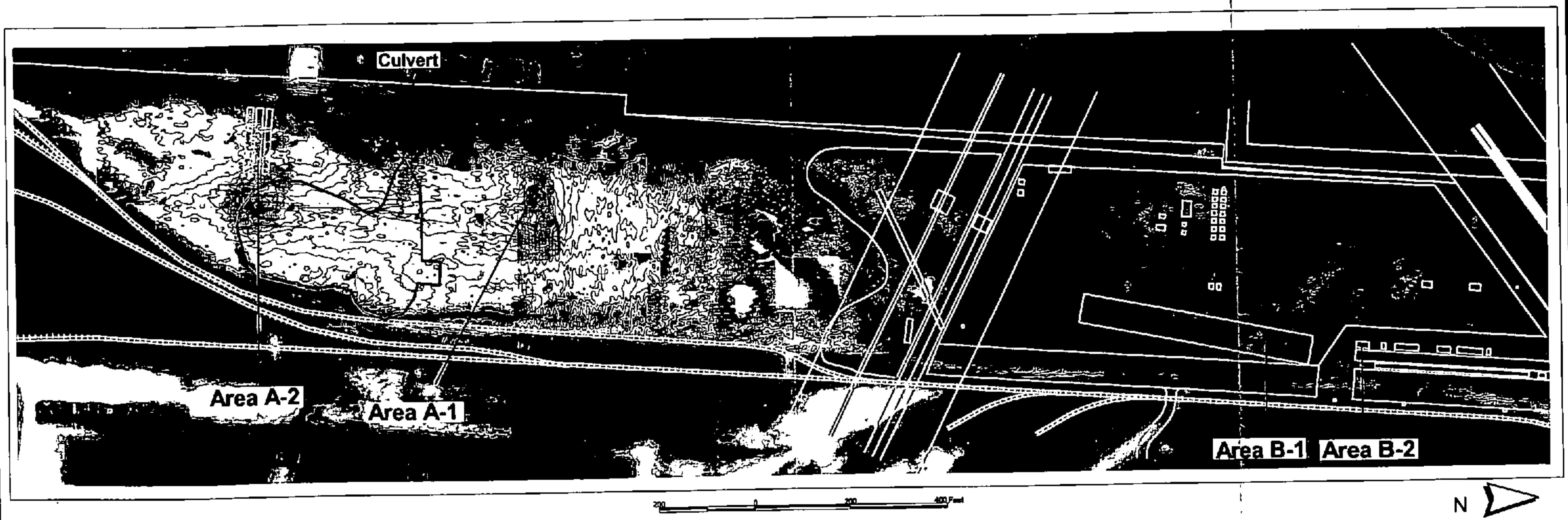
Disturbed Ground
Excavated
Trench

— 200
— 100
— 0
— -100
— -200

Magnetometer Readings in NanoTesla

PLATE 11
DUNN FIELD
1973 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 EM-31 Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



LEGEND

Excavated

— 80
— 60
— 40
— 20

EM-31 Readings in Millisiemen per meter

PLATE 12
DUNN FIELD
1973 Aerial Photograph / 1959 Drawing of Dunn Field/ 1998 Magnetometer Survey

Defense Distribution Depot Memphis
Memphis, Tennessee

LEGEND

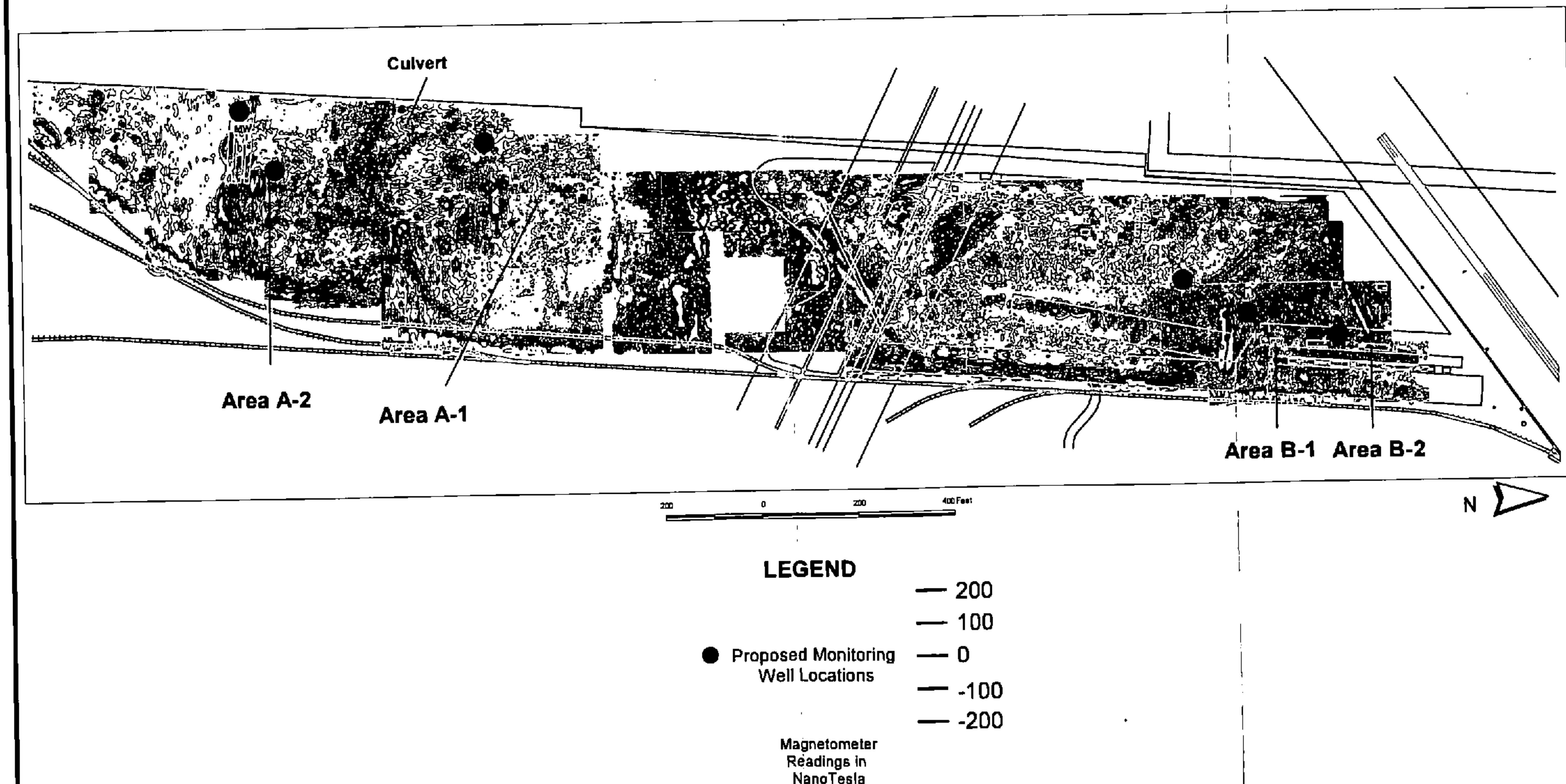
Excavated

— 200
— 100
— 0
— -100
— -200

Magnetometer Readings in NanoTesla

PLATE 13
DUNN FIELD
Proposed Monitoring Wells/ 1959 Drawing of Dunn Field/ 1998 Magnetometer Survey

Defense Distribution Depot Memphis
Memphis, Tennessee



FINAL

WORK PLAN TO CONDUCT SITE CHARACTERIZATION IN SUPPORT OF AN ENGINEERING EVALUATION/COST ANALYSIS AT OPERABLE UNIT 1 DEFENSE DISTRIBUTION DEPOT MEMPHIS MEMPHIS, TENNESSEE

Contract No. DACA87 - 95 - D - 0018
Task Order 19

Prepared for

U. S. Army Corps of Engineers
Huntsville Center

Prepared by

PARSONS ENGINEERING SCIENCE, INC.
5390 Triangle Parkway
Suite 100
Norcross, Georgia 30092

July 1998

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

Page

TABLE OF CONTENTS
(CONTINUED)

Page

TABLE OF CONTENTS (CONTINUED)

Page

TABLE OF CONTENTS
(CONTINUED)

LIST OF FIGURES

LIST OF TABLES

TAB

SECTION 1
INTRODUCTION

1.1 PROJECT AUTHORIZATION

Parsons Engineering Science, Inc. (Parsons ES) received Contract No. DACA87-95-D-0018, Task Order Z, from the Corps of Engineers, Huntsville Center (CEHNC), to conduct an Engineering Evaluation/Cost Analysis (EE/CA) at Areas A and B in Operable Unit 1 (OU1)at the Defense Distribution Depot Memphis, Tennessee (DDMT), (Figure 1.1). The EE/CA will be conducted in accordance with the National Contingency Plan (NCP), related Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Superfund guidance; and relevant U.S. Army regulations and guidance for ordnance and explosives (OE), and chemical warfare materiel (CWM) programs. The work required under this authorization falls under the Base Realignment and Closure (BRAC) and will be done to support the Remedial Investigation/Feasibility Study (RI/FS) currently in progress at DDMT.

1.2 PURPOSE AND SCOPE

1.2.1 The purpose of the Site Characterization Work Plan is to gather information on the nature and extent of suspected CWM burial pits at Dunn Field as well as to evaluate whether or not a response is needed, and selection of an appropriate response if one is necessary. The information gained from the site characterization will be used in performing a human health risk assessment and in preparing a Chemical Warfare Materiel Engineering Evaluation and Cost Analysis (EE/CA) to select removal actions necessary to reduce public safety risk associated with CWM at OU1. The purpose of this project is to determine the most appropriate response action to address any CWM risk at OU1 through an engineering evaluation and cost analysis of various remedial alternatives. The objectives of this project are listed below.

A. To determine if CWM, OE, degradation products, or decontamination constituents are present and are migrating from the burial sites.

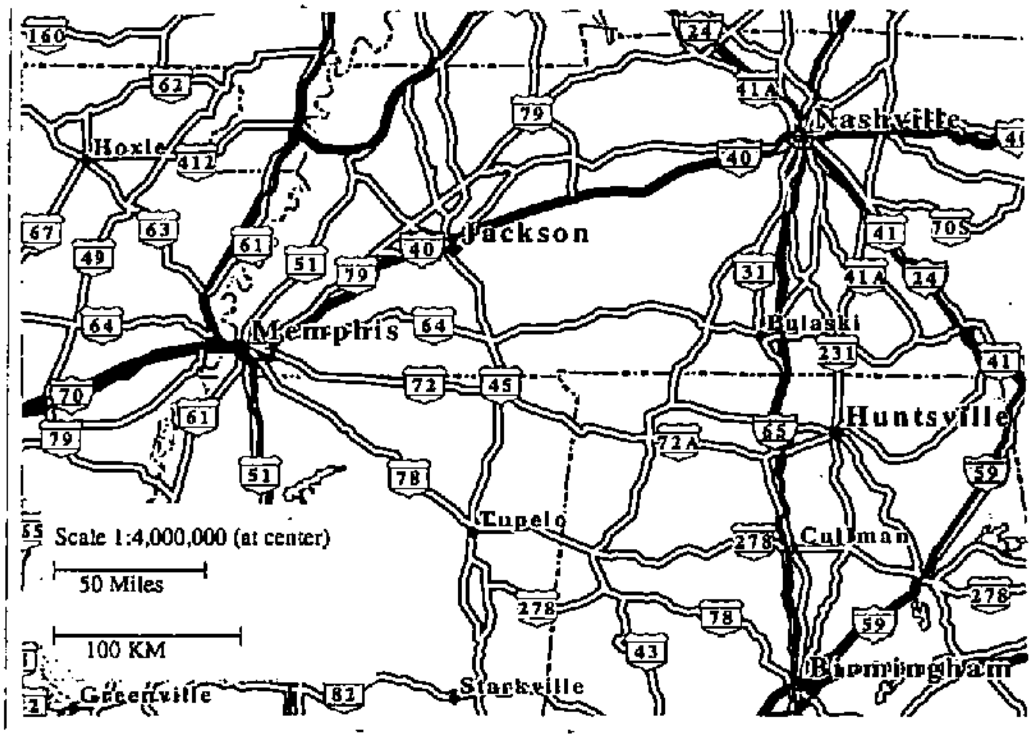
B. To characterize the extent and model the volume of CWM/OE contamination in order to assess and recommend removal action.

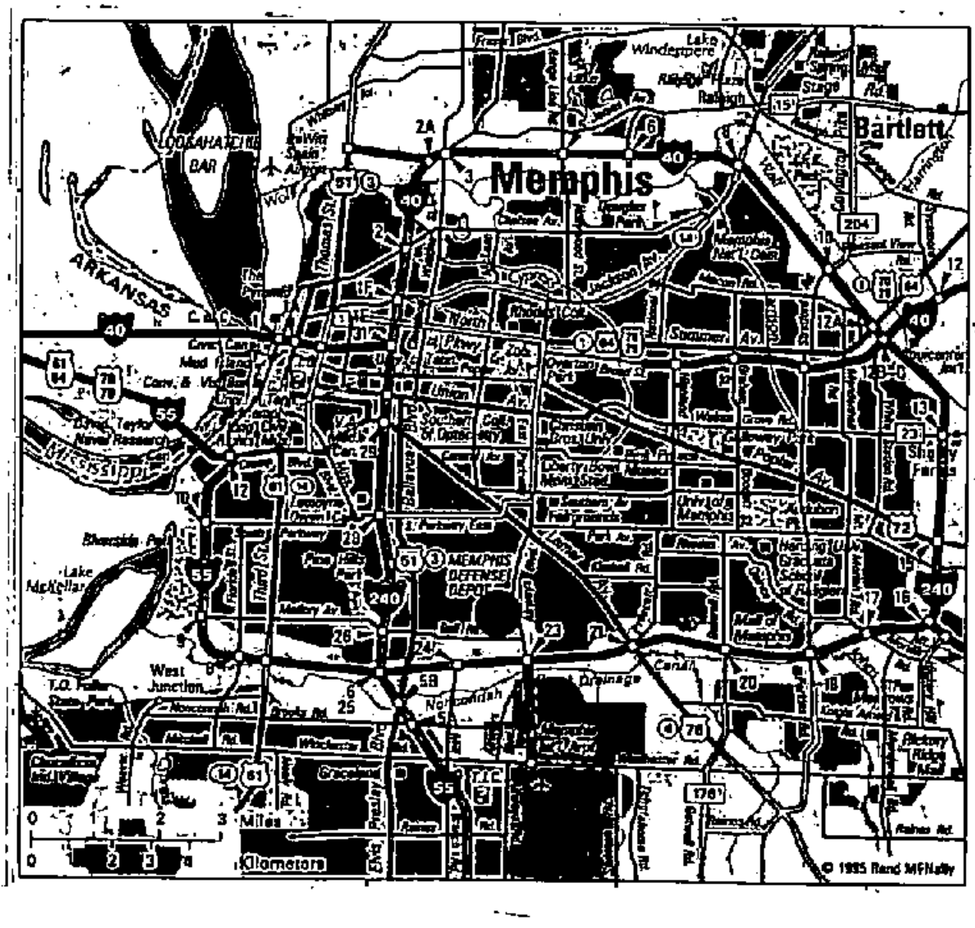
C. To develop a removal action plan that satisfies the EPA, State, Federal Government, and public concerns.

D. To provide location specific clearances for units within the suspect areas in order to facilitate progression of RI/FS investigations.

E. Prepare a quantitative human risk assessment and a qualitative ecological risk assessment for the site.

FIGURE 1.1
SITE LOCATION MAP
DEFENSE DISTRIBUTION DEPOT MEMPHIS
MEMPHIS, TENNESSEE





A. To devise and compare feasible alternative actions including a no action alternative.

B. To prepare an EE/CA that recommends and justifies appropriate preferred OE Removal Alternatives.

1.2.2 This Work Plan (WP) details the CWM investigation activities as stipulated in the CEHNC Statement of Work (SOW) for Task Order Z. The objective of this WP is to present the site background and history, investigation objectives, procedures, personnel, equipment and schedule to be used for the site characterization activities. The site characterization effort will involve sampling and data collection to determine: the location and boundaries of historic CWM neutralization/disposal pits and; if CWM or CWM degradation products have migrated from these areas into surrounding soil and groundwater. However, the scope of this task order does not include intrusive activities within the boundaries of the suspected disposal pits. The scope of work for this project is included as Appendix E.

1.2.3 Dunn Field (OU1) is divided into four Areas (Area A, B, C and D). Areas A and B are the only Areas were CWM was disposed of in the past. This Work Plan describes the major components of the work that will be conducted to complete the site characterization for Areas A and B at OU1, including:

- Review historical data, including the Archives Search Report (ASR), and other data that may be provided by the CEHNC;
- Visual inspection of the site, and collection of any additional relevant data that may be locally available;
- Prepare a WP (this document) for the field investigation that specifically includes the following subplans: Site Safety and Health Plan (SSHP); Quality Assurance Project Plan (QAPP); Site Specific Geophysical Investigation Plan (SSGIP); Site Specific Chemical Data, Laboratory and Field Work Plan; Site Specific Investigation Derived Waste (IDW) Plan; Work, Data, and Cost Management Plan (WDCMP); and Environmental Protection Plan (EPP).
- Perform a geophysical investigation;
- Install soil borings and monitoring wells;
- Perform surface/subsurface soil and groundwater sampling;
- Prepare Letter Reports presenting the findings of the site characterization which will include the geophysical results, analytical results, and IDW summary,;
- Arrangement of IDW disposal;
- Provide technical support to the government for meetings;
- Record and submit a video tape of field activities;
- Provide project management;
- Perform location surveys and mapping of the site;

- Prepare a quantitative human risk assessment and a qualitative ecological risk assessment for the site (optional);
- Prepare an EE/CA report (optional); and
- Prepare an Action Memorandum (optional).

1.3 WORK PLAN ORGANIZATION

This WP is organized to provide each of the required plan components in the SOW. Each of the required plan components are included or incorporated in the Sections and Appendices outlined in Table 1.1.

1.4 RISK ASSESSMENT

After completion of the site characterization, a quantitative human health risk assessment will be performed for Area A and Area B at Dunn Field. The risk assessment will evaluate potential impacts to human and ecological receptors exposed to OE, CWM and breakdown products in soil and/or groundwater at the facility. The risk assessment will be performed in accordance with USEPA's Risk Assessment Guidance for Superfund (RAGs) (1989) and all associated directives and updates from USEPA and EPA Region IV. A qualitative ecological evaluation will be performed. The evaluation will consist of site characterization and data screening against available criteria. No quantitative ecological risk assessment will be performed.

1.4.1 Human Health Risk Assessment

1..4.1.1 Prior to conducting the baseline risk assessment, data detected in site media will be screened against the following criteria for human health (EPA, 1995):

- EPA Region III Risk-Based Criteria (RBC) at a cancer risk level of 1×10^{-6} for carcinogens and a hazard index of 0.1;
- Two times mean background concentration for naturally-occurring inorganic chemicals; and
- Recommended Daily Allowances (RDAs) for essential nutrients.

1.4.1.2 Chemicals that do not screen out during the screening process are considered to be chemicals of potential concern (COPCs) and are evaluated in the quantitative baseline risk assessment.

1.4.1.3 A baseline human health risk assessment is completed in four tasks:

1. Data Evaluation;
2. Exposure Assessment;
3. Toxicity Assessment; and
4. Risk Characterization (including uncertainty analysis).

1.4.1.4 These four steps will be evaluated and potential carcinogenic risks and noncarcinogenic hazards will be derived for each appropriate human receptor. From the risk analysis, a list of preliminary chemicals of concern (COCs), as defined by EPA

(1995), will be developed and an uncertainty analysis will be completed to establish final COCs at the sites. A site visit and evaluation of site history by the human health risk assessor will define appropriate receptors and pathways of exposure to be evaluated at the facility.

1.4.2 Ecological Evaluation

1.4.2.1 For ecological receptors, a site characterization will be completed and the chemicals detected in site media will be screened against the following ecological criteria:

- EPA Region IV Supplemental Guidance to RAGS, Ecological Screening Values;
- EPA Region III Soil Screening Criteria (BTAGs) and toxicological benchmarks for soil from Will and Suter (1995); and
- Two times mean background concentration for naturally-occurring inorganic chemicals.

1.4.2.2 Chemicals that do not screen out during the screening process are considered to be chemicals of potential concern (COPCs). A quantitative ecological risk assessment will not be completed.

1.5 CHEMICAL WARFARE MATERIEL ENGINEERING EVALUATION AND COST ANALYSIS (EE/CA)

After completion of the site characterization and risk assessment, an Engineering Evaluation and Cost Analysis (EE/CA) report will be issued describing the field work and subsequent evaluations. In addition, the EE/CA report will also present the conclusions as to the nature and extent of CWM contamination along with the development, evaluation and recommendation for OE removal alternatives.

Table 1.1 Format and Content of the Site Characterization Work Plan for OU1

Section	Content
Section 1	Introduction
Section 2	Site Description and Previous Investigations
Section 3	Site Specific Geophysical Investigation Plan
Section 4	Site Specific Chemical Data, Laboratory and Field Work Plan including Quality Assurance Project Plan
Section 5	Site Specific Investigation Derived Waste Plan
Section 6	Work, Data, and Cost Management Plan
Section 7	Environmental Resources Protection Plan (ERPP)
Section 8	References
Appendix A	Parsons ES Site Specific Safety and Health Plan
Appendix B	Guide for UXO/CWM Avoidance
Appendix C	Field Forms
Appendix D	Resumes of Key Team Members
Appendix E	Statement of Work
Appendix F	Erdec Standard Operating Procedures
Appendix G	TEU Standard Operating Procedures

TAB

2

SECTION 2
CURRENT CONDITIONS

2.1 SITE DESCRIPTION AND BACKGROUND

2.1.1 Site Location

2.1.1.1 DDMT is located within the city limits of Memphis, Tennessee in southwest Tennessee (Figure 1.1), approximately 8 miles east of the Mississippi River and 6 miles north of the Tennessee-Mississippi State line (USATHAMA, 1982). The Memphis International Airport is located about one mile southeast of DDMT. The depot has been closed and is maintained by the Defense Logistics Agency and under the control of the Defense Distribution Region East (DDRE). The depot closed on September 30, 1997, and is currently under caretaker responsibility.

2.1.1.2 DDMT consists of approximately 642 acres and is comprised of the main depot, a bulk mineral storage/past waste disposal area, military housing, and outdoor recreational facilities. The major features of DDMT are shown in Figure 2.1. The bulk mineral storage area/past waste disposal area, known as Dunn Field, is located north of the main depot area. Based on information obtained from depot records and interviews with former depot military personnel, OE and CWM disposal occurred exclusively on Dunn Field (OU1). OU1 is divided into four separate areas (Areas A through D). Historical information indicates that CWM have been buried in trenches and or pits located in Areas A and B.

2.1.2 DDMT and Site History

2.1.2.1 DDMT was officially activated on January 26, 1942 as the Memphis General Depot. Since that time, the depot mission and functions have been related to the Army Engineer, Chemical, and Quartermaster Services. DDMT provided supply, stock control, storage, and maintenance for all three services (USATHAMA, 1982).

2.1.2.2 The history of OE and CWM disposal on Dunn Field began in July 1946 when twenty-nine mustard-filled German bombs were destroyed and buried. Most likely these bombs were filled with nitrogen mustard (US Army, 1995). These bombs were part of a rail shipment en route from Mobile, Alabama to Pine Bluff, Arkansas. Records indicate that some of the bombs were leaking and had resulted in the contamination of the rail lines and freight cars that contained the munitions (USATHAMA, 1982). Prior to reaching Pine Bluff, three railcars were identified as containing leaking munitions and these cars were transferred to the Memphis General Depot for proper handling. These railcars were staged in the main depot area for unloading and decontamination. As the bombs were unloaded from the railcars, those found to be leaking were taken to a slurry pit constructed in Dunn Field for draining of the mustard. The pit was reportedly 30 feet long, 7 feet wide, and 12 feet deep (USACE, 1995a, Section 5.2) and contained a chloride of lime slurry. The bombs were drained by shooting holes into the nose of the bombs using a rifle and allowing mustard to drain into the slurry pit. Reports indicate the drained bomb casings were then destroyed in a shallow trench using dynamite in case any of the bombs contained a burster charge. A total of twenty-four 500 KG and five 250 KG bombs were destroyed and of these only the small bomb casings contained a burster charge (USACE, 1995a, Section 5.2 and USACE, 1995b, Section 3.2). After draining and destruction operations were completed, all mustard contaminated items (wood, clothing, etc.) were placed into the slurry pit and trench and burned. The exact location of the slurry pit and trench for exploding burster charges is not known, however records indicate that the suspected location may be south of the existing parking lot in Area A (USACE, 1995a, Section 5.2 and USACE, 1995b, Map #3). Another possible location of the slurry pit has been identified as a series of three burial pits reported to contain chlorinated lime (USACE, 1995b, Map #3). The suspected location of these chlorinated lime pits is in the southern portion of Area A. Both suspected locations are shown in Figure 2.2.

2.1.2.3 During the early to mid 1950s, Chemical Agent Identification Sets (CAIS) were disposed and buried in Dunn Field. Three major varieties, including 17 different types of CAIS, were produced over three years (US Army, 1995). These sets were used by the military to train soldiers to identify chemical agents in the field (US Army, 1995). The CAIS disposed of at Dunn Field was probably set K951/K952 (US Army, 1995). Material safety data sheets (MSDS) for the agents found in the sets is included as Attachment A-5 of the Site-Specific Safety and Health Plan (Appendix A). The CAIS set disposed of at Dunn Field contained small glass ampoules of mustard and lewisite (a vesicant chemical agent) packed in a cardboard container which were stored in sealed cylindrical metal containers (USATHAMA, 1992 and US Army, 1995). In addition to mustard and lewisite CAIS K951/K952 contained chloropicrin and phosgene (US Army, 1995). At least six sets were disposed of at Dunn Field (USATHAMA, 1992). CAIS stocks found to be leaking or broken during periodic inspection were reportedly buried in Dunn Field (USATHAMA, 1982). The damaged CAIS may have been broken up and neutralized with chlorinated lime, however reports indicate that on at least five or six occasions that the sets were put into the pits intact (USACE, 1995a, Section 5.2 and USACE, 1995b, Section 3.2). In addition to the agents mentioned above chloroform was also included in the ampoules as a solvent (US Army, 1995). Each of the ampoules contained any where from 0% to 50% chloroform (US Army, 1995). The reported disposal areas are located in Area B and possibly Area A. The known location of CAIS disposal are shown in Figure 2.2. Records indicate that the larger area in Area B also contains out dated or damaged food stocks (USATHAMA, 1982, Figure 11 and Table 7 and USACE, 1995b, Map #3).

2.1.2.4 The remains of destroyed or partially destroyed OE are also buried in pits on Dunn Field (Area A). Reports indicate that a 3.2 inch mortar round, smoke pots, hand grenades (smoke), and other unspecified OE are buried in these pits (USACE, 1995a, Section 5.2, and USACE, 1995b, Section 3.2).

2.1.2.5 In addition to the chemicals and ordnance described above, various other chemicals associated with the use of chemical agents have been buried in Dunn Field. These chemicals include Impregnite (CC-2 and XXCC-3 both are waxed textiles), Decontaminating Agent, Non-Corrosive (DANC). The decontaminant DANC disposed at Dunn Field is an organic N-chloroamide compound in solution with 1,1,2,2-tetrachloroethane. DANC typically contained 90% to 95% 1,1,2,2-tetrachloroethane.

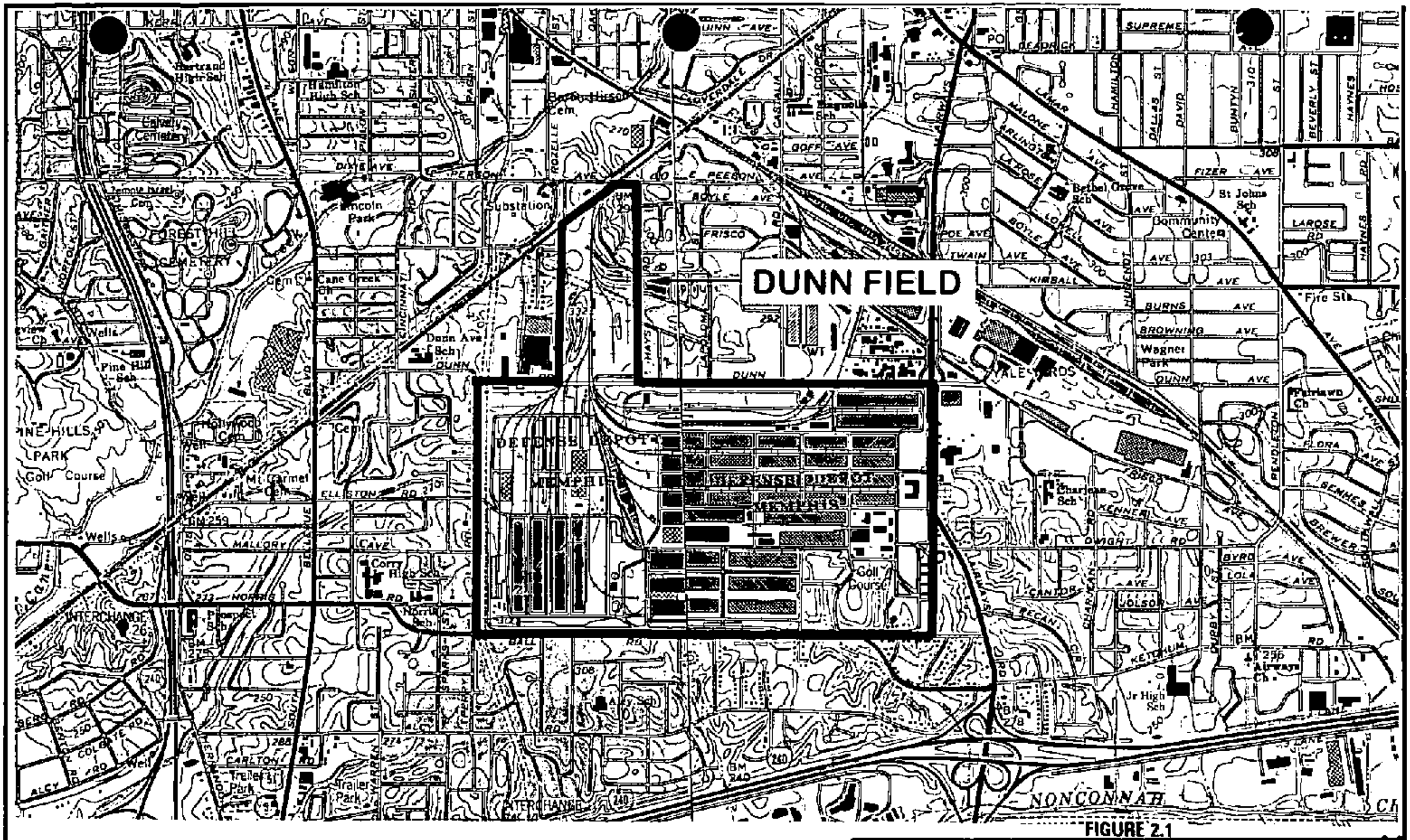


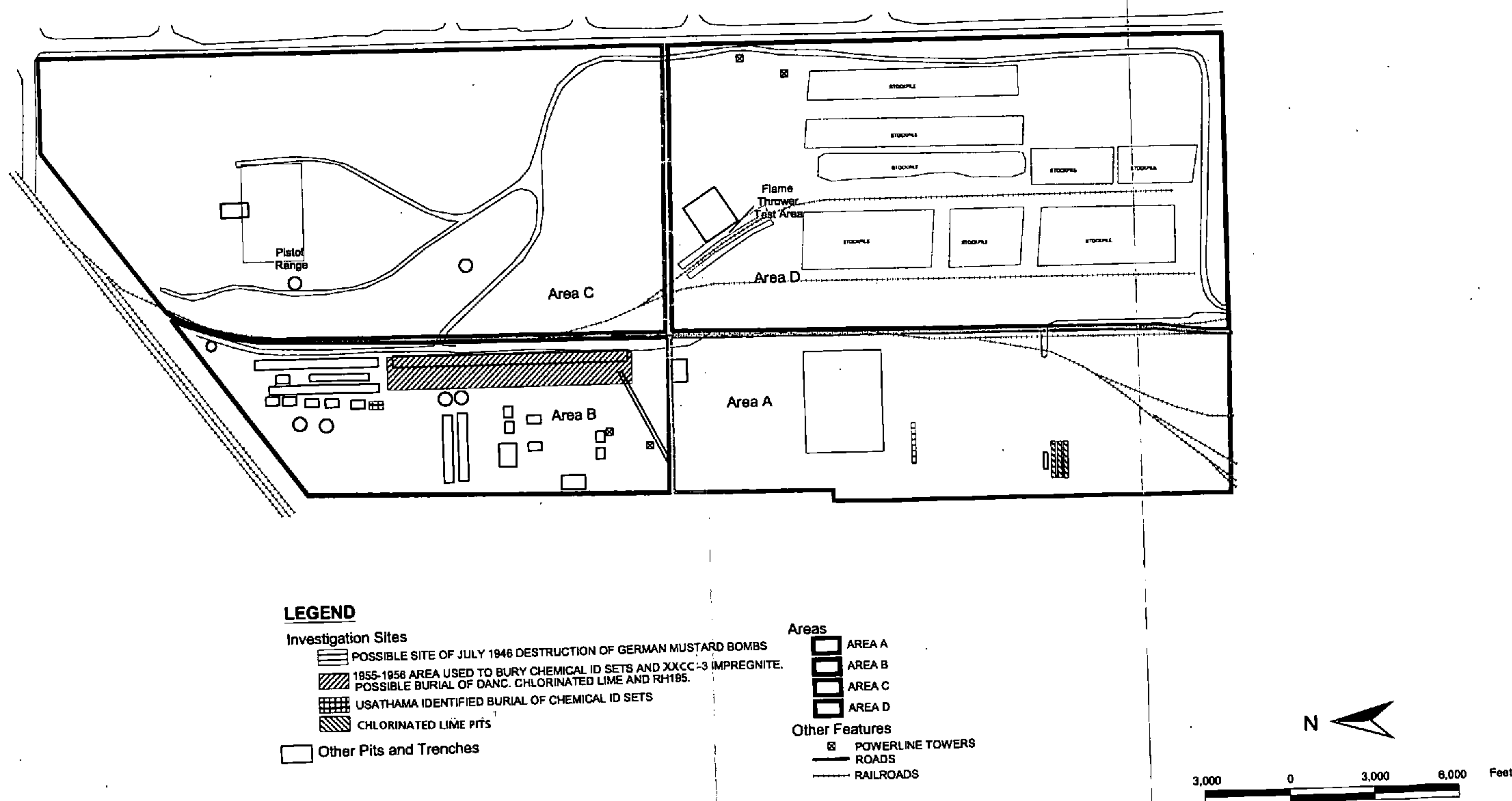
FIGURE 2.1

MAJOR FEATURES
DEFENSE DISTRIBUTION DEPOT
MEMPHIS, TENNESSEE

PARSONS ENGINEERING SCIENCE, INC.

DATE: OCT. 1997	CREATOR: CHRIS CIRILLO
PATH: J:\GIS\732283\AV	SOURCE: CEHNC

FIGURE 2.2
Site Map
Defense Distribution Depot
Memphis, Tennessee



PARSONS ENGINEERING SCIENCE, INC.

Chlorinating compound number 1 (an N-chloroamide) and 1,3-dichloro-5,5-dimethylhydantoin (RH-195) were used as organic chlorinating compounds in DANC. Food stocks, paints, acids, herbicides, and medical waste were also destroyed or buried in pits ands trenches in Dunn Field (CEHND, 1997). However, the scope of this investigation will be to focus on the presence of CWM or CWM byproducts related to mustard or lewisite in either soils or groundwater.

2.1.3 Site Geology and Hydrogeology

2.1.3.1 Geologic and hydrogeologic information for the shallow formations underlying DDMT has been collected and assimilated through a number of subsurface investigations over the past decade. As part of these investigations, regional geologic and hydrogeologic information has also been obtained and combined with site specific information to formulate a conceptual model of the subsurface below DDMT.

2.1.3.2 Section 1.3 of the *Final Groundwater Characterization Report* (CH2MHill, 1997) provides an in depth discussion of the shallow geology beneath DDMT. A regional geologic cross-section across area surrounding DDMT is provided in Figure 2.3. A discussion of the shallow geologic and hydrogeologic units beneath DDMT is provided below.

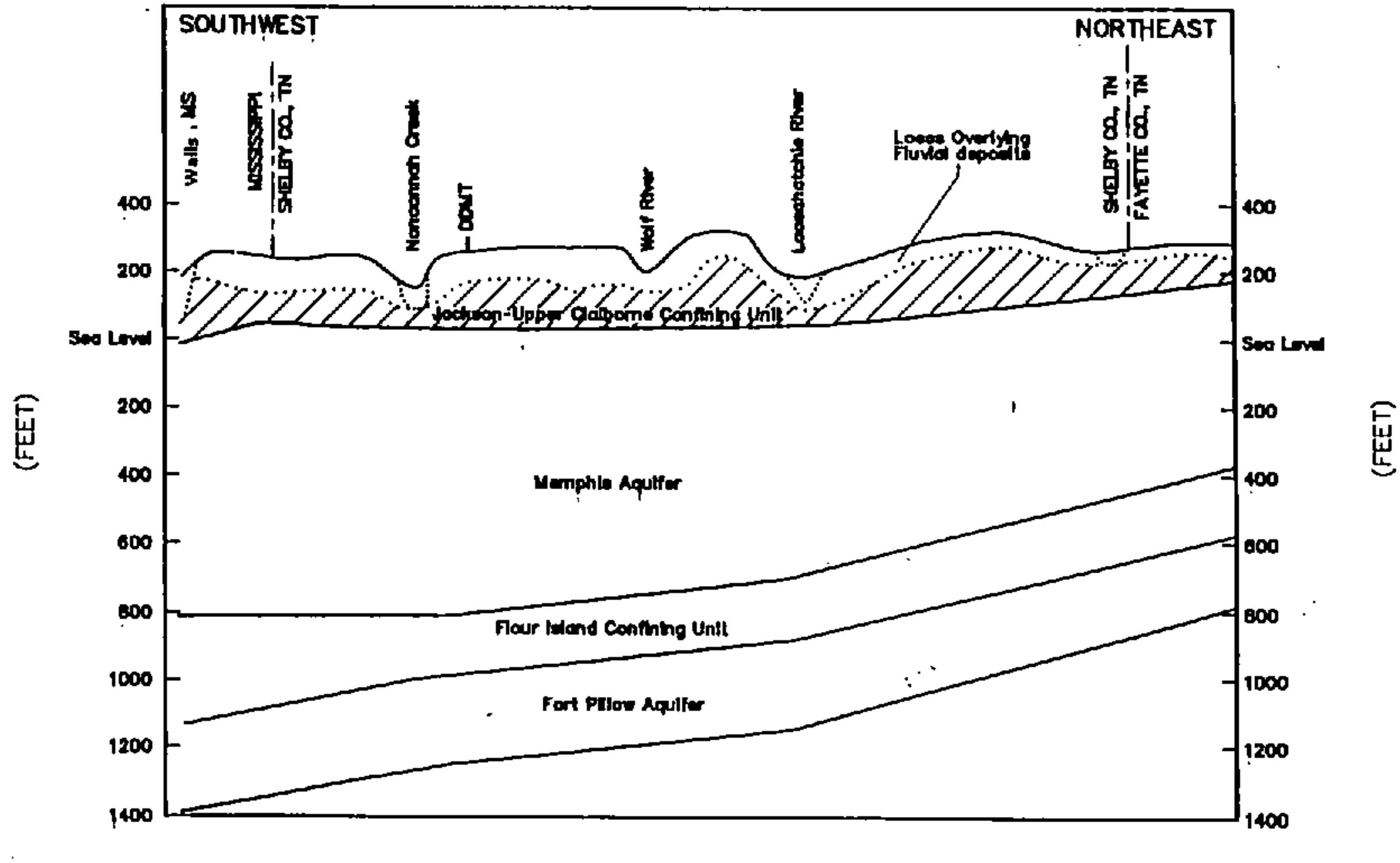
Geology

DDMT is underlain by a series of geologic formations starting with a layer of loess ranging from 20 to 30 feet in thickness. The loess is composed of silts and silty clay which may contain thin, discontinuous layers of fine sand (CH2MHill, 1997). Loess covers the land surface over extensive areas in the central United States and typically overlies alluvial deposits (CH2MHill, 1997).

The loess at DDMT is underlain by fluvial deposits predominated by sand and gravel with minor lenses of clay and thin layers of iron oxide cemented sandstone or conglomerate. The thickness of these deposits is highly variable (0 to 100 feet) due to the presence of erosional features on the top and base (CH2MHill, 1997). The uppermost aquifer at DDMT occurs within these deposits with the underlying Jackson Formation, Cockfield, and Cook Mountain Formations (known as the Jackson Formation/Upper Claiborne Group) forming the base of the aquifer.

At DDMT, the Jackson Formation/Upper Claiborne Group is encountered at depths ranging from 70 feet below land surface (bls) to approximately 160 feet bls in the northwest portion of Dunn Field (CH2MHill, 1997). The upper portion of this formation is composed of highly plastic clay of variable thickness of up to 85 feet in the northwest portion of Dunn Field (CH2MHill, 1997). This clay layer is underlain by sand units which may belong to the Cook Mountain formation (CH2MHill, 1997) or to extensive terrace deposits of the Memphis Sand.

The Memphis Sand is characterized by thick beds of very fine grained to gravely sand and micaceous sand with clay beds comprising a small percentage of the thickness (CH2MHill, 1997). Regionally, the top of the Memphis Sand ranges in depth from 120 to 300 feet bls and varies in thickness from 500 to 890 feet (CH2MHill, 1997). This aquifer serves as the primary drinking water source for the City of Memphis.



SOURCE: PARKS, 1990

FIGURE 2.3

GENERAL GEOLOGIC CROSS SECTION
DEFENSE DISTRIBUTION DEPOT
MEMPHIS, TENNESSEE

PARSONS ENGINEERING SCIENCE, INC.

DATE: OCT. 1997	CREATOR: CHRIS CIRILLO
PATH: J:\GIS\732283\AV	SOURCE: CEHNC

327 45

Hydrogeology

The uppermost aquifer beneath DDMT, the Fluvial Aquifer, is of primary interest in this project in terms of assessing whether CWM, explosives or associated degradation products have migrated from the disposal pits. A detailed discussion of the regional geology and hydrogeology is provided in the Final Generic Remedial Investigation/Feasibility Study Work Plan (CEHND, 1995). The Fluvial Aquifer occurs under unconfined conditions at DDMT with the water table forming the top of the aquifer and the Jackson Formation/Upper Clairborne Group forming the aquifer base. Zones of perched groundwater have been observed above clay lenses within the unsaturated portion of the fluvial deposits. Based on water level measurements taken in February 1996 and top of clay elevations presented by CH2MHill (1997), the saturated thickness of the Fluvial Aquifer varies from less than 5 feet near the northwest corner of the main depot area, to about 40 feet along the eastern boundary of the main depot. Saturated thicknesses in the Dunn Field area range from about 7 to 20 feet. Groundwater within the Fluvial aquifer beneath the Dunn Field flows generally westward as shown in Figure 2.4 with the exception of the southern third of Dunn Field in which groundwater flows to the southwest. Based on results from slug tests, the hydraulic conductivity of the aquifer ranges from 5.4×10^{-4} centimeters per second (cm/sec) to 2.3×10^{-2} cm/sec with a mean value of 7.8×10^{-3} cm/sec (CH2MHill, 1997).

2.1.4 Topography

The terrain within and surrounding DDMT is relatively flat. Terrain in the main depot area varies in elevation from 280 to 300 feet mean seal level (msl) with exception of the golf course which varies from 260 to 300 feet msl in elevation. The Dunn Field area is relatively flat at approximately 300 feet msl except for the northeast corner where the land elevation ranges from 260 to 300 feet msl (USATHAMA, 1982).

2.1.5 Surrounding Land Use

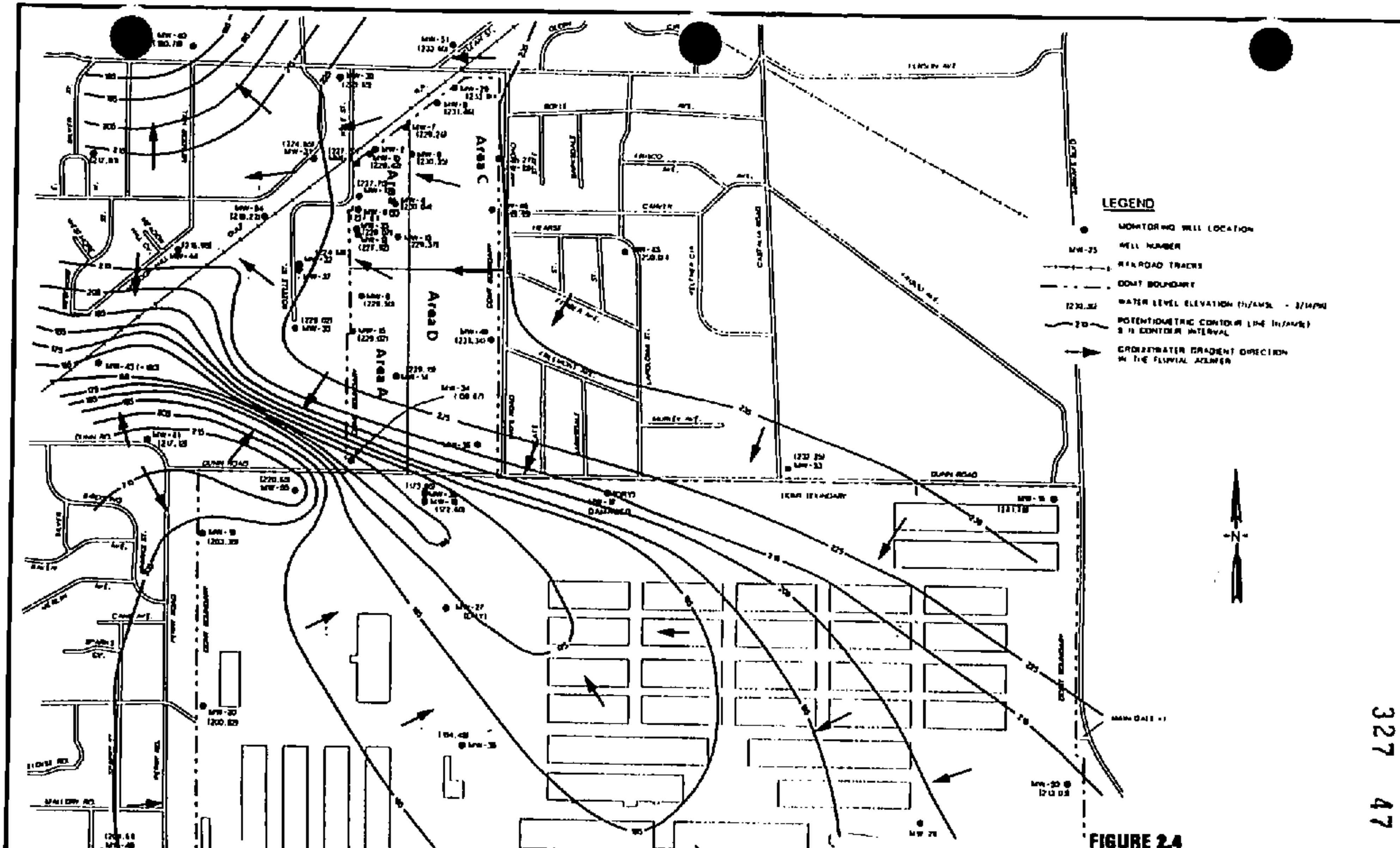
The area surrounding DDMT is urban consisting of primarily residential properties with lesser numbers of commercial and light industrial properties. A number of schools and churches are located within several miles of the depot. The Memphis International Airport is located approximately one mile southeast of DDMT and is surrounded by a variety of commercial and industrial properties. Several public parks and golf courses are located within several miles of DDMT.

2.1.6 Meteorology

2.1.6.1 Based on data referenced in the Installation Assessment (USATHAMA, 1982), the average annual temperature for Memphis, Tennessee is 62 degrees Farenheit (°F) with an annual nominal temperature range from -13°F to 106°F. The average summer temperature is 80°F and the average winter temperature is 40°F.

2.1.6.2 Average monthly precipitation ranges from 2.7 inches in October to 6.1 inches in January. The average annual snowfall is 6.1 inches. The average relative humidity is 70 percent and the prevailing wind direction is from the southwest.

327 47



SOURCE: CH2M HILL, 1996

FIGURE 2.4

POTENTIOMETRIC SURFACE MAP
DEFENSE DISTRIBUTION DEPOT
MEMPHIS, TENNESSEE

PARSONS ENGINEERING SCIENCE, INC.

DATE: OCT. 1997	CREATOR: CHRIS CIRILLO
PATH: J:\GIS\732283\AV	SOURCE: CEHNC

2.2 PREVIOUS INVESTIGATIONS

2.2.1 1992 USATHAMA Installation Assessment of DDMT

In 1992, USATHAMA, Aberdeen Proving Ground, Maryland, conducted an installation assessment of DDMT. This study concluded that "a potential exists for contaminant migration from DDMT via surface and subsurface routes." Locations identified as potential sources of contaminant migration included burial sites at Dunn Field. Recommendations included the surface and subsurface investigation of the identified areas to determine if contaminants were migrating offsite.

2.2.2 1995 OEW/CWM Archives Search Report

In 1994, the USACE, St. Louis District conducted a site inspection and archives search of DDMT (USACE, 1995). The final report, dated January 1995, outlined the nature and degree of ordnance and explosive waste/chemical warfare materiels (OEW/CWM) contamination thought to be found at DDMT. This report identified burial sites in the Dunn Avenue Area (Dunn Field) thought to contain destroyed or buried OEW and CWM. This report also stated that "no evidence of the burial or destruction of Conventional Ordnance or Chemical Warfare Materiels on the main depot could be found".

2.3 NATURE AND EXTENT OF OEW/CWM CONTAMINATION

2.3.1 To date, no field investigations have been conducted to determine the nature and extent of OEW/CWM contamination at Dunn Field. Results from interviews with former DDMT personnel and review of archive records indicate that CWM and OE have been destroyed and/or buried in pits and trenches at Dunn Field.

2.3.2 Records from the handling and disposal of the German mustard bombs in 1946 indicate that the bombs were drained into a neutralization pit filled with a chloride of lime slurry. The bomb casings were then destroyed using explosives in a separate pit at Dunn Field. The nature of the mustard in the slurry pit has not been confirmed, however mustard disposed in the slurry pit is believed to have been neutralized by the chloride of lime. It is also possible that the burning was effective in destroying the mustard. Further investigation is necessary to ascertain the current condition. Reportedly, it is possible for globules of mustard in a neutralization slurry to form a protective outer shell of mustard which could result in the preservation of mustard inside the globule. Also, mustard contained in the destroyed bomb casings represents a potential source of mustard at Dunn Field. A test conducted at the Black Hills Depot in which mustard was drained from bomb resulted in 35 percent of the contents remaining in the bomb casing (USACE, 1995b). Further, the ASR reported that the "use of dynamite to detonate the bursters may not have removed any residue mustard. The final burning of all materiels in the trench/pits using fuel oil would not have produced the temperatures necessary to cause the mustard to be incinerated." The suspected locations of the slurry pit and burster charge destruction pit are shown in Figure 2.2. The extent of mustard or mustard degradation product migration from these areas is unknown.

2.3.3 A second potential source of mustard is associated with the disposal of damaged CAIS sets in trenches/pits located in Area B of OU1. The CAIS sets contained glass ampoules filled with mustard and the chemical agent lewisite. The ASR reported that the remains of CAIS sets "may still contain Chemical Agents in glass vials. Vials which were broken at the time of burial may also present a danger, along with contaminated soil." Two former disposal pit/trench areas, shown in Figure 2.2, are suspected to contain the subject CAIS sets. The location and distribution of the CAIS sets within these areas is unknown.

TAB

3

SECTION 3
SITE SPECIFIC GEOPHYSICAL INVESTIGATION PLAN

3.1 OBJECTIVE

The objective of the geophysical investigation is to investigate/characterize two areas within Areas A and B at OU1 suspected to have burial pits where CAIS sets, bomb casings (drained German mustard gas bombs) and/or a slurry of mustard gas and chlorinated lime may have been buried. This objective will be achieved by accurately locating and recording the location of geophysical anomalies that represent potential burial pit locations.

3.2 GEOPHYSICAL INVESTIGATION

3.2.1 Geophysical Field Team

The geophysical field team will be comprised of a Parsons ES geophysicist and a CMS UXO-qualified escort. Responsibilities of the geophysicist will include ensuring that the survey grid is setup properly, leading the geophysical operations, and processing and interpreting the data. The CMS escort will be responsible for ordnance avoidance in the investigation areas and assisting the geophysicist during the surveys.

3.2.2 Surveying

3.2.2.1 The site will be divided into grids for the purpose of accurately recording anomaly locations detected during the geophysical investigation. The sizes of the grids will be dependent upon site topography and surface features but will primarily be 100 ft by 100 ft. All grids will be laid out in a due-north orientation. A site map showing the approximate grid layout is presented as Figure 3.1.

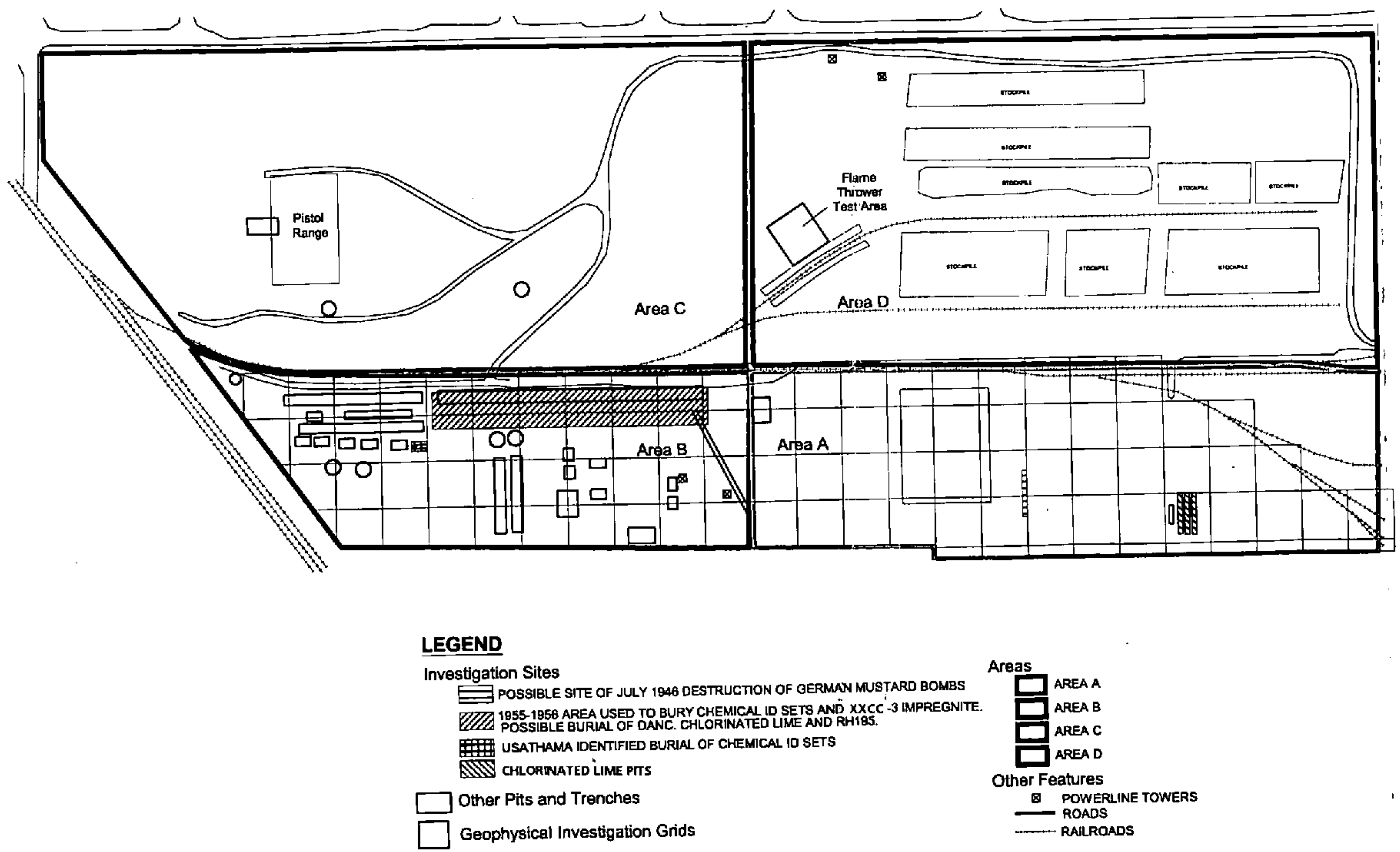
3.2.2.2 The field team will assist a surveyor registered in the state of Tennessee in the placement of the grids. The CMS escort will electronically sweep the area prior to driving any survey stakes into the ground. Stakes will not be driven into the ground if an anomaly is discovered within 2 feet of the intended location for the stake. An alternate location will be selected as close as permissible to the original location and electronically swept for anomalies.

3.2.2.3 The surveyor will establish and survey the corners of the grid. The corner coordinates will be tied to state plane grid coordinates via local coordinates.

3.2.3 Base Map

A base map of the site will be prepared with corresponding grid markings and control points. The corners of each grid will be located and the surveyor will provide control points. The corner coordinates will correspond to state plane grid coordinates.

FIGURE 3.1
Geophysical Grids
Defense Distribution Depot
Memphis, Tennessee



3.2.4 Quality Control

3.2.4.1 Prior to beginning work each day, geophysical equipment will be checked in an area designated for calibration. Results of the calibration will be recorded in the site logbook. The control area will be solely dedicated to conducting daily checks of the instruments. An instrument reading differing more than 25 percent from the baseline reading may suggest equipment failure or procedural error.

3.2.4.2 A base station will be established for the magnetometer survey where readings can be taken to correct total intensity readings. The base station will be located in an undisturbed area. Base station readings will be collected at one second intervals. The location of the base station will be recorded in the field notebook.

3.2.4.3 The geophysical data collected in the field will be reviewed at several stages. The first quality check will be during data collection. The field team will be able to check the data logger to ensure that data is being collected and examine the data during data logger "dumps" when the information is downloaded to the hard drive of a portable computer. A second quality check will occur at the end of each day when the data is reviewed and formatted for use. A third quality check will be performed when the data is loaded into the mapping software.

3.2.4.4 Each member of the field team will have the opportunity to comment on the data and procedures used to collect the data. If it appears that a particular geophysical method or instrument is not generating meaningful results, field activities will be suspended and the situation will be reviewed by the geophysical team leader, Parsons ES Project Manager and Mr. Lynn Helms of CEHNC. A decision will then be made as to whether the instrument or method will continue to be used to complete the survey.

3.2.5 Geophysical Survey Equipment

A site-specific geophysical prove-out was performed at the site on January 30 and 31, 1998 and a letter describing the results of the prove-out was sent to the CEHNC project manager. A copy of this letter is attached at the end of Section 3. Two geophysical methods, frequency domain electromagnetics (EM) and magnetics were selected to be used at the site to perform the geophysical surveys. The instrumentation will include the Geonics® EM-31 terrain electromagnetic conductivity meter and the Geometrics® G-858 magnetometer (or equivalent).

3.2.5.1 EM-31

3.2.5.1.1 The EM-31 instrument generates an electromagnetic pulse that triggers eddy currents (created by a time variant magnetic field) in the subsurface. The eddy current decay produces a secondary time-variant magnetic field that is monitored by a receiving coil and recorded by the attached data logger. The magnitude of the received signal is linearly related to the apparent (terrain) conductivity.

3.2.5.1.2 The EM-31 collects continuous data in two components, quadrature (conductivity) and in-phase (ratio of the secondary to the primary magnetic field). Measuring both the quadrature and in-phase components allows differentiation between waste with and without metallic debris. The in-phase component of the conductivity signal measured is especially useful for detecting buried metal. The effective depth of exploration of the instrument is approximately 18 feet.

3.2.5.1.3 The EM-31 conductivity measurements are subject to cultural interferences from sources such as power lines and surface metallic objects (i.e. fences, cars, metallic debris). A large number of these interferences can severely impact the results of a survey.

3.2.5.2 G-858

3.2.5.2.1 The G-858 instrument is a cesium magnetometer sensor comprised of a miniature atomic absorption unit from which a signal proportional to the intensity of the ambient magnetic field is derived (Pawlowski, et. al., 1995). The sensitivity of the instrument is 0.005 nanoTesla (nT) and can collect data at a frequency of up to ten times per second.

3.2.5.2.2 The G-858 measures the earth's total magnetic field strength and when used as a gradiometer (two sensors) it also measures the magnetic field gradient. Ferrous objects cause localized disturbances in the earth's total magnetic field that are measurable with the magnetometer. The greater the mass, the more disturbance to the total field is created. The effective depth of exploration of the instrument depends on the mass of ferrous material in the subsurface.

3.2.5.2.3 Magnetometry data may be affected by electrical storms, solar flares, and magnetic storms as well as local sources of ferrous materials (i.e. fences, metallic debris) or magnetic noise (i.e cellular phones, walkie talkies). Diurnal or daily changes in the earth's magnetic field also occur and must be compensated for. This is accomplished by establishing a base station where measurements are taken at regular intervals throughout a survey and the survey data is later adjusted based on the variations at the base station.

3.2.6 Geophysical Survey Procedures

3.2.6.1 The geophysical techniques selected for the site investigation are affected by various environmental conditions (see Section 3.2.4). These conditions will be taken into consideration when performing daily verification on the geophysical survey equipment as well as during data collection.

3.2.6.2 The grid system laid out by the surveyor will be used to divide the site into geophysical survey quadrants. The quadrants will be numbered and will be relationally connected using an x,y coordinate system. This system will be tied into the local coordinate system if possible. The field team will establish survey transects with a five-foot separation across each grid in a north-south alignment. Geophysical data will be collected along these transects.

3.2.6.1 EM-31

3.2.6.1.1 The field team will collect continuous electromagnetic data along the survey transects in each grid. The EM-31 unit will be operated by the geophysicist using an automatic data logger. The CMS escort will assist the geophysicist in tracking his location using a series of cones or flags to accurately keep the transect line. Transects may cross several grids where this method is deemed most effective.

3.2.6.1.2 At least twice each day, data collected in the data logger will be downloaded to a laptop computer. At the end of the day, the data will be normalized to the grid coordinate system. At this point, the geophysical data will be reviewed to assure that the EM-31 is properly calibrated and that the coordinates of the readings correspond to the proper locations within the surveyed grids.

3.2.6.2 G-858

3.2.6.2.1 The G-858 will be set up and checked following the procedures in the instruction manual provided with the instrument. The instrument check-out will be conducted in an area free from cultural interferences, and will include an instrument battery check and tuning the instrument to the ambient field.

3.2.6.2.2 The field team will collect continuous magnetic data along the survey transects in each grid. An automatic data logger will be used to store the data as it is collected. At least twice each day, data collected in the instrument will be downloaded to a laptop computer using the software accompanying the instrument.

3.2.7 Data Analysis

3.2.7.1 Data collected with each of the geophysical instruments will be post-processed in the field after downloading. Post-processing will primarily involve ensuring that survey lines were correctly recorded with respect to their survey direction, distance, and grid coordinates. During the EM-31 and G-858 surveys, the survey lines are traversed over a known distance with data being collected incrementally with time. Data markers are inserted by the operator into the data at specified distance intervals over the course of the traverse. Post-processing compresses or expands the data collected between each marker to cover the same distance interval. This is necessary because of minor variations in the speed at which the operator walks along the survey line.

3.2.7.2 After post-processing and data-checking is complete, the geophysical data will be processed into an ASCII delimited file. The data will then be input into a mapping software package (Surfer® for Windows or comparable) and the locations and magnitudes of the geophysical signals will be plotted on a plan-view map. The locations of potential burial pits (if found) will be selected from the anomaly maps and coordinates for these locations will be presented. Final versions of the data and output files shall be compatible with Intergraph Microstation. Both electronic and hardcopy versions will be delivered to CEHNC.

3.2.8 Records

A daily journal (log) will be kept documenting onsite activities. A minimum of twenty 3" x 5" color photographs will be taken documenting site activities. Descriptions of the photographs will be kept in the site log and a video will be provided that shows representative site activities.

SITE-SPECIFIC GEOPHYSICAL PROVE-OUT LETTER

PARSONS ENGINEERING SCIENCE, INC.

A UNIT OF PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC

Suite 500 • 57 Executive Park South, N.E. • Atlanta, Georgia 30329-2265 • (404) 235-2300 • Fax (404) 235-2500

February 2, 1998

U.S. Army Engineering and Support
Center Huntsville
4820 University Square
Huntsville, Al 35805-1957
ATTN: CEHNC-OE-CM (Mr. Steve
Dunn)

Subject: Recommendations for Geophysical Survey Equipment, Defense Distribution Depot Memphis, Tennessee

Dear Mr. Steve Dunn:

Parsons Engineering Science, Inc. (Parsons ES) has completed an on-site prove-out of three geophysical instruments. The prove-out was performed on January 30, 1998 and January 31, 1998. The prove-out included the burial of five objects at various depths and orientations. The geophysical instruments used in the prove-out were an EM-31, EM-61 and a G-858 magnetometer.

Parsons ES is recommending the use of the G-858 magnetometer and the EM-31 during the field work scheduled for the week of February 2, 1998. Mr. Lynn Helms (CEHNC) observed the prove-out and concurred with the observations and recommendations provided below.

G-858 Magnetometer

1. The G-858 identified all of the buried metallic items during prove-out.
2. Surveying with the G-858 is fast and therefore cost effective.
3. Parsons ES recommends use of a base station with a sampling interval of 1 per second.
4. Parsons ES recommends that the G-858 instrument be allowed to warm-up until signal(s) stabilize at 50%.

EM-31 Terrain Conductivity Meter

1. The EM-31 identified a suspected trench location during the prove-out. Identification of the trench location was possible even under unfavorable conditions such as close proximity to railroad tracks and power lines.
2. Surveying with the EM-31 is fast and therefore cost effective.
3. The EM-31 is the best method for locating trenches/disturbed areas as described in literature and as found through past experience.

327 58

4. The EM-31 provides the best potential for detection of the slurry pit. The G-858 will not find the slurry pit unless metal is present.

5. Parsons ES recommends that the EM-31 be allowed to warm-up for at least 5 minutes.

If you have any questions or need additional information, please call me at (404) 235-2424 or Jimmy Duncan at (404) 235-2375.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Thomas H Beisel, P.G.
Project Geologist

TAB

4

SECTION 4
SITE SPECIFIC CHEMICAL DATA, LABORATORY AND FIELD WORK PLAN

4.1 OBJECTIVES

This section describes the general sampling, laboratory, monitoring well installation, soil boring procedures, and quality assurance/quality control (QA/QC) procedures to be followed during the site investigation. The Defense Distribution Depot Memphis, Tennessee (DDMT) Generic Quality Assurance Project Plan (QAPP) (CH2MHill, September 1995) was used as a reference. This Site Specific Chemical Data, Laboratory and Field Work Plan addresses the field activities, locations and quantities of subsurface soil, surface soil, and groundwater samples, sampling tools, and the analytical methods and equipment to be used. This plan will also describe site specific parameters not included in the Generic QAPP.

4.2 DATA QUALITY OBJECTIVES

Data Uses and Data Quality Levels

The primary uses of data collected during the sampling activities are contaminant characterization, health and safety, risk assessment, evaluation of alternatives, and engineering design of alternatives. There are 4 categories of data quality (Levels 1,2,3, and 4) corresponding to the level of supporting QA/QC documentation required. All four Levels are discussed in the Generic QAPP.

4.3 FIELD SAMPLING PROCEDURES

General Sampling Requirements

4.3.1 The following general sampling requirements will be maintained:

- Prior notification of facility to obtain entry permits for personnel.
- Field sampling teams will consist of a minimum of two individuals. One person will collect the sample as the other monitors adherence to sampling procedures, records any difficulty encountered, and documents other information pertinent to the investigation. A UXO supervisor will be part of every sampling team.
- To the extent feasible during sampling episodes, sampling activities in each medium will be conducted so that the sampling order will be from the area of least contamination to the area of most contamination.
- Sample collection for chemical analysis will be performed with either disposable sampling devices or decontaminated, stainless steel or Teflon® devices. When composite samples are required, the sample will be homogenized in glass bowls.

All sampling equipment will be decontaminated in accordance with the procedures outlined later in this plan.

- Precleaned sample containers will be provided by the analytical laboratory. All sample container records will be maintained by the analytical laboratory and will be available upon request.
- A sample that is representative of the matrix being sampled will be collected.
- All samples will be analyzed initially onsite at the ERDEC mobile laboratory for CWM and CWM breakdown products. Samples shown to be free of CWM agents will be sent to an off site laboratory for the analyses summarized in Table 4.1.
- Sample integrity will be maintained from the time of sample collection to receipt by the laboratory.

4.3.2 All field notes will be recorded in indelible ink on standard forms in bound notebooks. A daily field log will be completed, signed, and dated daily. Significant events occurring during the day will be recorded and reported to the PM. Daily communication is essential to evaluate whether timely corrective actions are necessary. The field notebook(s) must provide a place for the field team members to sign and data the entries. The field team leader (FTL) must review all field notes.

4.4 FIELD ANALYSIS

A split of all samples will be analyzed in the field for CWM and CWM breakdown products to determine which samples will be sent to an offsite laboratory for further analysis. The split sample will be transported by the on site Parsons sampling personnel to the ERDEC mobile laboratory for agent analysis. Once the sample has been confirmed non agent contaminated, then the original sample will be released to the environmental laboratory for analysis. No sample will leave the site until ERDEC has provided results on the split sample to identify the sample as free of agent. Parsons ES will maintain sample control while awaiting the results from ERDEC. No additional analysis or QA/QC procedures are required for the CWM/CWM breakdown product sample analysis.

4.5 SAMPLE BLANKS AND FIELD DUPLICATES

The two types of sample blanks- equipment (rinsate) blanks, and field blanks, along with field duplicates, split samples, and matrix spike/matrix spike duplicates will be collected for the off site sample analyses. The descriptions, collection procedures, and frequencies of each QC sample are discussed below.

4.5.1 Equipment Blanks

Equipment rinsate blanks are used to detect any contamination introduced during sample collection procedures due to the sampling equipment. Rinsate blanks for the groundwater samples are processed by rinsing decontaminated sampling equipment with organic-free deionized water. The rinse water is collected in sample bottles, preserved, and handled in the same manner as the samples. Equipment blanks will be collected once for each type of sampling equipment used during sampling procedures.

4.5.2 Field Blanks

Field blanks are samples of source water used for decontamination and are used to monitor the potential for contamination from the source water. The source water will be poured directly from the original container into sample bottles, preserved and handled in the same manner as the samples. One field blank will be collected once from the water source used for sampling activities.

4.5.3 Field Duplicates

Field duplicate samples are collected to measure the precision of the sampling process. The FTL will choose at least 10 percent of the total number of sample locations previously known to contain moderate contamination, if possible, and will collect duplicate samples from these locations. The source information will be recorded in the field notes, but not on the chain-of-custody (COC) form prepared by the field team at the time of sample collection. The identity of the duplicates will not be given to the analysts. The source information will be forwarded to the QA reviewer to aid in the review and validation of the data. The source of the field duplicate for the QA samples will be clearly identified on the COC form sent to the QA laboratory.

4.5.4 Split Samples

Split samples are used to calculate the precision of the sampling and analytical processes by providing a measure of comparability between laboratories Split samples will be collected from 5 percent of the samples collected at DDMT for off site laboratory analyses for the purpose of a quality control check by the Corps of Engineers' laboratory in Missouri. Also, TDEC reserves the right to collect split samples and to analyze these samples by the State of Tennessee laboratory.

4.5.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD samples will be collected and shipped to the laboratory for spike analyses. Only samples that are found to be free of agent will be analyzed as MS/MSD samples. Triple sample volume will be collected for samples designated as MS/MSD samples. However, no MS/MSD samples will leave the site until ERDEC releases the samples as agent free. Five percent of the samples collected will be accompanied by spike samples. However, if a spike sample has not been collected in a 14-day time period, a spike sample will be collected and sent for analyses.

4.5.6 Off Site Analysis Sample Summary

A summary of the proposed samples to be collected and analyzed for this project are presented below in Table 4.1.

Table 4.1
Summary of Proposed Samples
Defense Depot Memphis, TN

Parameter	Method	Matrix	Est. Number of Environmental Samples	Number of QA Samples EB	FB	FD	MS
Dithiane/ Oxathiane	UL04 (mod)	Water	8	1	1	1	1
Thiodiglycol	UW22 (mod)	Water	8	1	1	1	1
Explosives	SW8330	Water	8	1	1	1	1
ICP Metals	SW6010	Water	8	1	1	1	1
Mercury	SW7470	Water	8	1	1	1	1
Dithiane/ Oxathiane	LL03 (mod)	Soil	44	1	1	4	3
Thiodiglycol	LW18 (mod)	Soil	44	1	1	4	3
Explosives	SW8330	Soil	44	1	1	4	3
ICP Metals	SW6010	Soil	44	1	1	4	3
Mercury	SW7471	Soil	44	1	1	4	3

Note: No samples will be sent offsite for analysis of the above CWM breakdown products unless the samples have been screen by the onsite ERDEC lab as free of CWM agent (mustard, lewisite etc.).

EB - Equipment Rinsate Blank

FB - Field Blank

FD - Field Duplicate

MS - Matrix Spike/Matrix Spike Duplicate Sample

4.6 FIELD DOCUMENTATION

4.6.1 Bound field log books will be maintained by the FTL and other team members to provide a daily record of significant events, observations, and measurements during sampling events. All entries will be signed and dated. All information pertinent to sampling will be recorded in bound log books with numbered pages. Entries in the log book must include at least the following:

- Name and title of author, date and time of entry, and weather/environmental conditions during field activity
- Location of sampling activity
- Name and title of field crew
- Name and title of any site visitors
- Sample media (for example, groundwater)
- Sample collection method
- Number and volume of sample(s) taken

- Date and time of collection
- Sample identification number(s)
- Sample distribution (for example, laboratory)
- Water level measurement data
- Field observations
- Any field measurements made, such as pH, temperature, and conductivity
- All sample documents such as:
  - Bottle lot numbers
  - Dates and method of sample shipments
  - COC forms
- Sample handling (preservation)

4.6.2 All original data recorded in field log books, sample labels, and COC forms will be written with waterproof, black, indelible ink. None of these accountable, serialized documents are to be destroyed or thrown away, even if one is illegible or contains inaccuracies requiring document replacement. If an error is made on an accountable document assigned to one individual, that individual should make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections will be initialed and dated.

4.7 SAMPLE CONTAINERS

The FTL is responsible for proper sampling, labeling of samples, preservation, and shipment of samples to the laboratory to meet required holding times. Table 4.2 identifies the proper containers, preservation techniques, and maximum holding times according to EPA SW-846.

Table 4.2
Required Sample Containers, Preservation, and Holding Times
Defense Depot Memphis, Tennessee

Analyses	Sample Matrix*	Container†	Quantity	Preservative**	Holding Time
Thiodyglycol					
(GPES UW22 mod)	W	40-mL vials††	2	Cool 4°C	7/40 days***
(GPES LW18 mod)	S	8-oz Glass	1	Cool 4°C	7/40 days***
Dithiane/Oxathiane					
(GPES UL04 mod)	W	1-L amber glass	1	Cool 4°C	7/40 days***
(GPES LL03 mod)	S	1-L amber glass	1	Cool 4°C	7/40 days
Explosives					
(SW8330)	W	1-L amber glass	1	Cool 4°C	7/40 days***
(SW8330)	S	1-L amber glass	1	Cool 4°C	7/40 days
Metals (Total)					
(SW6010)	W	1-L polyethylene	1	Cool 4°C, HNO_3, pH <2	6 months
	S	8-oz Glass	1	Cool 4°C	6 months
Mercury					
(SW7040)	W	1-L polyethylene	1	Cool 4°C, HNO_3, pH <2	24 hours
(SW7471)	S	8-oz Glass	1	Cool 4°C	24 hours
Thiodyglycol					
(U109)	W	40-mL vials††	2	Cool 4°C	7/40 days***
(LL09)	S	8-oz Glass	1	Cool 4°C	7/40 days***
Dithiane/Oxathiane					
(GPES UL04 mod)	W	1-L amber glass	1	Cool 4°C	7/40 days***
(GPES UL03 mod)	S	1-L amber glass	1	Cool 4°C	7/40 days
Metals (Total)					
(6010, 7000)	W	1-L polyethylene	1	Cool 4°C, HNO_3, pH <2	6 months
	S	8-oz Glass	1	Cool 4°C	6 months
Mercury					
(7040)	W	1-L polyethylene	1	Cool 4°C, HNO_3, pH <2	24 hours
	S	8-oz Glass	1	Cool 4°C	24 hours

*Sample matrix: S = Surface soil, subsurface soil;
W = Groundwater.

†Glass containers will be sealed with Teflon®-lined screw caps.

**All samples will be stored promptly at 4°C in insulated chest.

***Holding Times: 7 days for extraction, 40 days for analysis.

4.8 SAMPLE NUMBERING SYSTEM

4.8.1 A sample numbering system will be used to identify each sample collected during the field investigation and for all blanks. The numbering system will provide a tracking procedure to allow retrieval of information about a particular location and to monitor that each sample is uniquely numbered. The samples will be identified by the following sample designation scheme:

PROJECT - DATE - SAMPLING - LOCATION SAMPLE - TYPE/DEPTH SAMPLE NUMBER

where,

project =	Defense Distribution Depot Memphis Tennessee Site (DDMT)
date =	date of sample collection (month, day, year)
sampling location =	MW1 for monitoring well number 1 SB for soil boring number 1 SS1 for surface soil sample number 1 EB for equipment rinsate blank FB for field source blank.
sample type =	grab (G) or composite (C)
sample number =	first, second, third, etc.--sample collected from same location

4.8.2 Therefore, a sample designation code DDMT-091298-SB1-10-12'-01 would indicate the first sample from "soil boring 1" that was collected on September 12, 1998 at a depth of 10-12 feet. Similarly, a sample designation code DDMT-091298-EB-G-1 would indicate equipment rinsate blank number one shipped on September 12, 1998 from the Site.

4.8.3 Field duplicates will not be identified on the chain-of-custody form; these samples will be given fictitious sample designation codes. The field duplicates, however, will be identified in the field logbook.

4.9 SAMPLE CHAIN-OF-CUSTODY

4.9.1 Sample custody and documentation procedures described in this section will be followed throughout all sample collection at DDMT. Components of sample custody procedures include the use of field log books, sample labels, custody seals, and COC forms. Each person involved with sample handling will be trained in COC procedures before the implementation of the field program. The COC form will accompany the sample during shipment from the field to the laboratory. If samples are split and sent to different laboratories, a copy of the COC form will accompany each split sample.

4.9.2 The information provided on the COC form will include the following:

- The project name
- The sampling station number or sample number

- Date and time of collection
- Grab or sample designation
- A brief description of the type of sample and sampling location
- Signature of individuals involved in the sample transfer
- The time and date they receive the sample
- Sample matrix
- The analytical methods required

4.9.3 COC records initiated in the field will be placed in a plastic cover and taped to the inside of the shipping containers used for sample transport from the field to the laboratory. This record will be used to document sample custody transfer from the field sampler to the laboratory.

4.9.1 Sample Custody

A sample is under custody under the following conditions:

- It is in your actual possession; or
- It is in your view, after being in your physical possession; or
- It was in your physical possession and then you locked it up to prevent tampering; or
- It is in a designated and identified secure area.

4.9.2 Sample Custody in the Field

The following procedures will be used to document, establish, and maintain custody of field samples:

- Sample labels will be completed for each sample, with waterproof ink, making sure that the labels are legible and affixed firmly on the sample container.
- All sample-related information will be recorded in the project log book.
- The field sampler will retain custody of the samples until they are transferred or properly dispatched.
- During the course of and at the end of the field work, the field supervisor determines whether these procedures have been followed, and whether additional samples are required.

4.10 SAMPLE SHIPMENT

4.10.1 Samples will be delivered to the designated laboratory. During sampling and sample shipment work, the FTL (or a designee) will contact the appropriate laboratory daily to inform it of shipments. Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. Styrofoam or bubble wrap will be used as packing material to protect the samples from breakage during shipment. After packing is complete, the cooler will then be taped shut with COC seals affixed across top and bottom joints. Each container will be clearly marked with "THIS END UP" arrows on all four sides and a sticker containing the originator's address.

4.10.2 The following procedures will be used when transferring the samples for shipment;

- Samples are accompanied by a COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person, or to the laboratory. Overnight carriers will be treated as a single entity and a single signature will be required when the samples are delivered to the laboratory.
- Samples will be properly packaged for a shipment and dispatched to the appropriate laboratory for analysis with a separate signed COC form enclosed in each sample box or cooler.
- Whenever samples are split with a government agency, a separate COC form will be prepared for those samples and marked to indicate with whom the samples are being split.
- All packages will be accompanied by a COC form showing identification of the contents. The original record will accompany the shipment, and a copy will be retained by the FTL.

4.11 LABORATORY SAMPLE CUSTODY

4.11.1 The FTL will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped, as well as the expected date of arrival.

4.11.2 The following procedures will be used by the laboratory sample custodian in maintaining the COC once the samples have arrived at the laboratory:

- The laboratory will designate a sample custodian who is responsible for maintain custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original COC and request-for-analysis documents and compare them with the labeled contents of each sample container for corrections and traceability. The sample custodian signs the COC and records the date and time received. The sample custodian also will assign a unique laboratory sample number to each sample.
- Care is exercised to annotate any labeling or descriptive errors. In the event of discrepancies in the documentation, the laboratory will immediately contact the FTL as part of the corrective action process. A qualitative assessment of each sample container is performed to note any anomalies, such as broken or leaking bottles. This assessment is recorded as part of the incoming COC procedure.

- If all data and samples are correct, and there has been no tampering with the custody seals, the "received by laboratory" box is signed and dated.
- The samples are stored in a secured area and at a temperature of approximately 4°C, if necessary, until analyses are to begin.
- Samples are accompanied by a COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person, or to the laboratory.
- A laboratory COC form accompanies the sample or sample fraction through final analysis for control.
- Copies of the COC and request-for-analysis forms will accompany the laboratory report and will become a permanent part of the project records.

4.12 FIELD PROCEDURES

4.12.1 Groundwater

Groundwater sampling efforts will be conducted to identify and evaluate CWM contaminants in the groundwater beneath and around the disposal pits at Dunn Field. Table 4.2 provides minimum laboratory QC sample requirements, including container type, container quantities, preservatives, holding times, and SW-846 Method or laboratory-specific Standard Operating Procedure (SOP) for each parameter.

4.12.1.1 Groundwater Sample Locations and Rationale

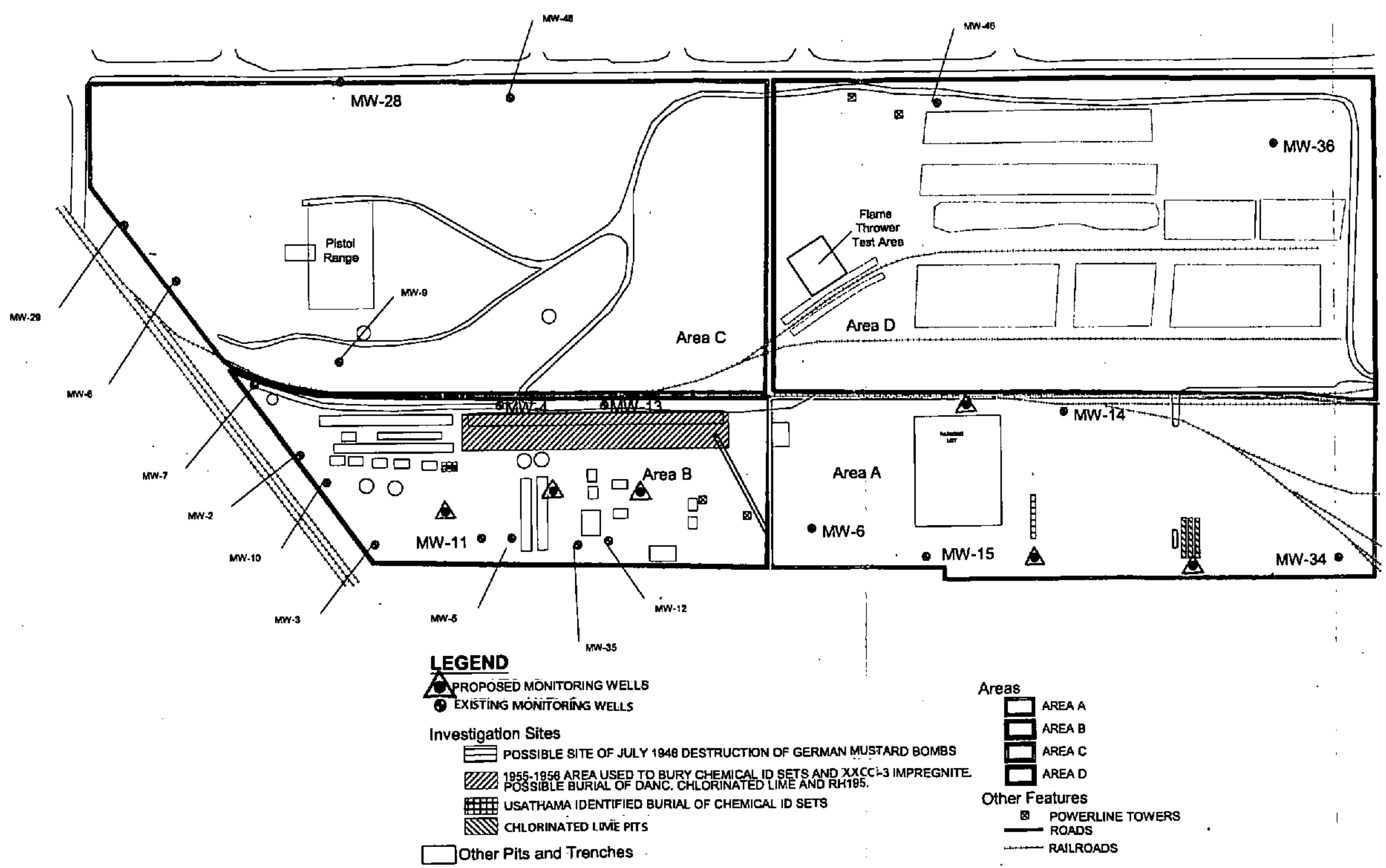
Groundwater samples will be collected for chemical analysis from both existing and newly constructed monitoring wells at Dunn Field. Existing monitoring wells are deemed to be too distant from the specific pit/trench locations to enable a reasonable assessment of the releases from these sites. Therefore, six additional wells are to be installed in Areas A and B of Dunn Field (Figure 4.1). All six of the wells will be constructed in the Fluvial Aquifer to a depth of from 80 to 90 feet below land surface (bls) at a minimum of 25 feet from the trenches and pits. The Fluvial Aquifer is around 70 feet bls and is the water table. Two of the newly installed wells will be at downgradient locations to the two suspected CWM disposal pits located in Area A. One well will be installed upgradient of the Area A disposal pits. Three wells will be installed down gradient of the two suspected CWM disposal pits in Area B. Groundwater samples will be collected from two existing wells, MW-13 and MW-14, as upgradient wells. Well MW-13 will address the CAIS disposal trench area and MW-14 will be used as an upgradient well of the slurry pit. Groundwater samples from the wells will be analyzed to evaluate whether releases have occurred from CWM disposal sites at Dunn Field. Additional samples to be analyzed will include blanks and field duplicates.

4.12.1.2 Groundwater Sampling Procedures

4.12.1.2.1 Before groundwater sample collection, static water levels in the monitoring wells will be measured within 24 hours of purging the monitoring well.

4.12.1.2.2 Groundwater levels used to construct a groundwater potentiometric surface map will be collected within a 24-hour time frame. All water levels will be

FIGURE 4.1
Monitoring Well Location Map
Defense Distribution Depot
Memphis, Tennessee



measured using a decontaminated, electronic water level indicator with an accuracy of plus or minus 0.1 foot. Monitoring well sampling will generally proceed from the potentially least contaminated well to the most contaminated well, according to existing data.

4.12.1.2.3 To prevent contamination of sampling equipment by surface soils when the wells are being purged or sampled, a plastic ground cloth will be placed beneath all sampling equipment. Purging will be accomplished through the use of a decontaminated stainless steel submersible pump or Teflon® bailer. If a bailer is used then the metals portion of the sample will be collected first. The discharged water will be monitored for pH, temperature, and specific conductivity. Purging will continue until three to five well volumes have been removed and the pH, temperature, and conductivity are stabilized (three successive measurements are within 5 percent of one another).

4.12.1.2.4 The amount of purged fluid will be measured by filling graduated buckets or by using a stopwatch and noting the flow rate of the pump versus elapsed times. All water purged from the wells will be permitted for discharge to the City sewer. Wells will be sampled immediately after purging. The purge rate must not exceed the recharge rate of the well. Wells that recharge slowly will be purged dry and allowed to recharge to at least 80 percent of initial well volume before sampling. If excessive time (greater than 10 hours) is required for the slow recharging wells to recharge to 80 percent, it will be documented by the FTL in the field log. To monitor that data is consistent, all wells will be sampled within a 10-day time frame.

4.12.1.2.5 Clean disposable vinyl gloves will be used to handle all samples and equipment used for purging and sample collection. Each well will be sampled with a Teflon® bailer decontaminated according to procedures described previously. Precleaned bailers will be wrapped in aluminum foil for transportation to DDMT. A clean, braided nylon cord will be used to lower each bailer into the well and will be discarded after each use. Care will be taken to prevent contact between the bailer and line and the ground.

4.12.1.2.6 Samples will be collected in accordance with the guidelines furnished in the *Practical Guide for Ground Water Sampling* and the *EPA Region IV EIPSOPQAM.* In accordance with EPA's Environmental Services Division guidelines, care will be taken to avoid aeration of the sample. The sample will be poured in a slow, steady stream from the bailer to the prepared sample containers. The process will be repeated as necessary to fill each container to the required volume. Field measurements of pH, specific conductance, and temperature will be conducted and recorded using instruments that have been calibrated daily and decontaminated before each use. Temperature will be measured immediately upon pouring the sample from the bailer into a glass beaker.

4.12.2 Soil

4.12.2.1 Surface Soil

Surface soil samples will be collected and analyzed to characterize these soils for CWM and CWM degradation products. Surface soil samples will be taken at 8 locations. Boring locations will be screened geophysically prior to sampling to stay clear of geophysical anomalies. Only samples analyzed in the field by ERDEC as not showing indications of mustard or lewisite will be shipped to the laboratory for analysis. Container type, container quantities, preservatives, holding times, and SW-846 Method or laboratory-specific SOP for each parameter are provided in Table 4.2. This section identified the general requirements and purposes for collection of surface samples, including the field QA/QC methods.

4.12.2.2 Surface Soil Sampling Procedures

Surface soil samples will be collected using a clean stainless-steel hand auger or scoop to retrieve soil from zero to 6 inches below ground surface (bgs). The sample will be divided into two (2) sub-samples. One sub-sample shall be used to take off-gas headspace readings to insure CWM is not present. The other sub-sample will be analyzed for CWM/OE and constituents/degradation products. Surface cover (grass and weeds) and debris (such as broken glass and rocks) will be removed from the sample prior to placing in sample containers.

4.12.2.3 Subsurface Soils

Subsurface soil samples will be collected for chemical analyses from monitoring well borings installed for this study (Figure 4.1). Samples will taken at two foot intervals and analyzed in the field for CWM and CWM degradation products by the ERDEC mobile laboratory. Borings will not be advanced more than two feet without geophysical screening for additional anomalies. Only samples released in the field by ERDEC as not showing indications of mustard or lewisite will be shipped to the offsite laboratory for analysis. A maximum of six soil samples from each boring will be shipped offsite for analysis. The overall purpose of this sampling effort will be to characterize the subsurface conditions by providing soil samples for chemical analysis to determine the nature and extent of releases of CWM and CWM degradation products to the environment from the Area A and B waste disposal sites at Dunn Field, as well as the vertical and horizontal extent of such contamination in the subsurface soils; to evaluate soil lithology and subsurface stratigraphy. Additional samples to be analyzed include equipment blanks and field duplicates (to fulfill QA/QC requirements).

4.12.2.4 Subsurface Soil Sampling Procedures

Six subsurface soil samples will be collected from each monitoring well boring. Soil samples for analysis will be collected on the basis of visual, ERDEC field screening or organic vapor analyzer/photoionization detector (OVA/PID) field screening. Soil samples will be stored in airtight containers and shipped daily to the laboratory for analysis. The final decision to collect a sample from a certain zone will be based on the results of CWM sample screening conducted on site by ERDEC. If any mustard or lewisite is detected during the soil boring drilling, all work at that boring will stop immediately, any containerized cuttings will be covered, and the borehole will be covered with plastic sheeting. All downhole equipment which may have come in contact with agent will be assessed and turned over to the Government if contaminated. This decision will be documented in the field log.

4.12.3 Soil Boring and Monitoring Well Drilling Procedures

4.12.3.1 Permitting and Design of Monitoring Wells

The design and construction of monitoring wells will follow (as closely as practical) the design criteria presented in the *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells* and *EPA Region IV EIPSOPQAM.*

Diagram of typical well construction details are shown in Figure 4.2. Drilling and field personnel will have all applicable state and local certification required for drilling.

4.12.3.2 Installation of Monitoring Wells and Soil Borings

The procedures described below will be followed for monitoring well installation and soil borings.

4.12.3.3 General Requirements

The drilling contractor will provide all drilling equipment, materials, and personnel required to install the monitoring wells and soil borings. A qualified geologist or geotechnical engineer will be onsite for all drilling, installation, development, and testing activities. Borings will not be advanced more than two feet without geophysical screening for additional anomalies.

4.12.3.4 Drilling and Well Installation Techniques

Drilling techniques will be followed as described below:

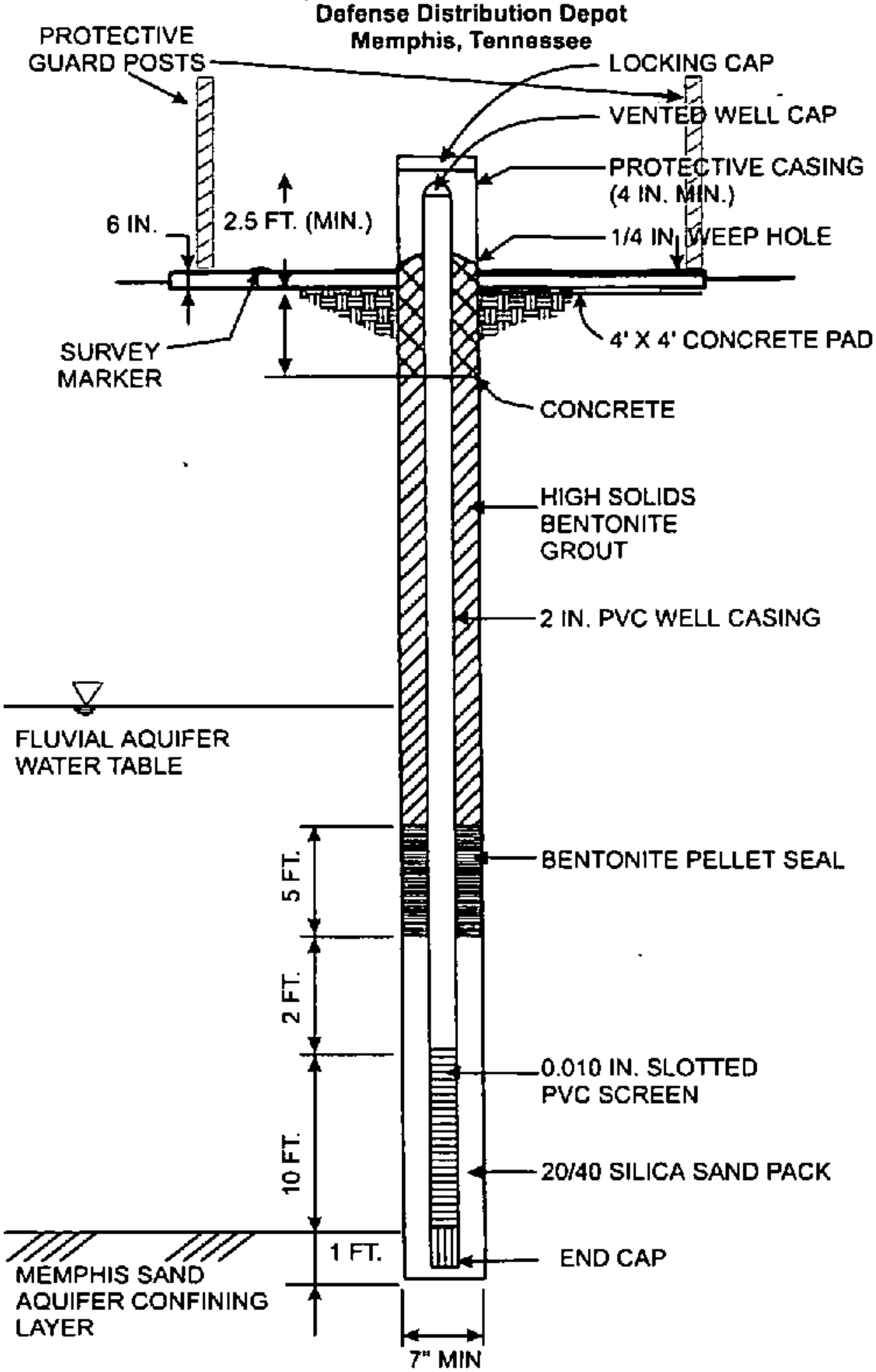
Soil Borings. The Dunn Field soil borings and monitoring wells will be installed using hollow stem auger (HSA), mud rotary (MR), or another EPA-approved alternative drilling technique. Only bentonite drilling mud will be used

HSA technique is preferable for installation of the monitoring wells and will be used whenever possible. A zone of flowing sand has been encountered during previous drilling operations at DDMT. If the auger becomes ineffective in the sands, a center plug will be used. MR will be used only as necessary, to drill borings below the water table. The drill rigs will install a minimum 7-inch-diameter borehole to facilitate installation of 2-inch inside diameter (ID) casing and screens for the Fluvial Aquifer monitoring wells. The drill rig will have the capability to collect split-spoon samples according to ASTM procedures. At a minimum, the rig will be equipped with a cathead-operated, 140-pound hammer with a 30-inch draw.

Hollow Stem Auger Technique. When a boring is advanced using HSA, the following protocol will be followed to install the well casing and screen in the shallow wells:

- Install the 2-inch screen and riser through the HSAs with enough riser pipe to extend the well casing about 2 feet above the ground surface.
- Install an artificial sand pack through the annular opening, using a tremie pipe. Water in small amounts may be used to prevent bridging of the sand in the annulus.
- Remove hollow stem augers in increments as the annulus space fills with sand.
- Continue installing sand pack until it reaches at least 2 feet above the top of the well screen.
- Install a minimum 5-foot pure bentonite seal of a least 20 percent solids using a tremie pipe.

Figure 4.2
Typical Stickup Monitoring Well
Defense Distribution Depot
Memphis, Tennessee



NOTE:
4-2" DIAMETER GUARD POSTS ARE REQUIRED (EQUAL SPACINGS) AROUND PROTECTIVE CASING. EXTEND POSTS 3'-6' ABOVE TOPE OF PAD.

J:\732283\figure.cdr

- Remove HSAs from boring.
- Grout boring annulus to within 2 feet of ground surface using a tremie pipe and high solids pure bentonite grout. Install steel security cap and a 4-foot by 4-foot by 6-inch concrete pad with 4 protective posts if the well is in a high-traffic area. The grout will be allowed to set a minimum of 48 hours before developing the well.

Mud Rotary Technique. The MR technique will be used only as necessary with as little solids as possible used. When a boring is advanced using MR, the protocol described below will be followed to install the well casing and screen in the shallow wells:

- After termination of boring, all drilling rods will be removed.
- Install the 2-inch screen and riser, with enough riser pipe to extend about 2 feet above the ground surface. Centralizers may be necessary to center the pipe in the borehole.
- Remove the mud cake from the boring well by pumping potable water through the well riser and screen.
- Install the sand pack with a tremie pipe from the bottom of the boring until at least 2 feet above the top of the well screen.
- Install a minimum 5-foot bentonite seal.
- Grout boring annulus to within 2 feet of the ground surface using a tremie pipe and high solids, pure bentonite grout. Install steel security cap and a 4-foot by 4-foot by 6-inch concrete pad with 4 protective posts. The grout will be allowed to set a minimum of 48 hours before developing the well.

Borehole Abandonment Procedures

If for any reason a well must be abandoned during drilling, the well will be grouted from bottom to top with Portland cement grout, and the casing cut off tow (2) feet below ground surface.

4.12.3.5 Well Design

The monitoring wells will be designed similarly to existing wells on site and will follow the Generic QAPP used by CH2MHill. The wells for this investigation will be constructed to allow use in the ongoing RI/FS even though the chemicals for analysis in this project are not the same as those in the RI/FS. Material compatibility for the RI/FS has been considered in the following well design.

Well Riser and Screen. The risers and screens used in well construction will be made of polyvinyl chloride (PVC) (meeting National Sanitation Foundation [NSF] Standard 14).

Additionally, previous analytical results from existing monitoring wells at DDMT indicate that contamination is not affecting well materials. There has been no indication of degradation of the well materials resulting in well failure or leaching or organics from the well materials. Thus, the sample and data quality will not be adversely affected by using PVC (CH2MHill, 1997). Continued use of PVC for well construction materials will provide water samples that will be consistent with samples from the existing monitoring wells without sacrificing data quality.

Riser. Wells installed for this investigation are to be installed in the Fluvial Aquifer and will be constructed of new threaded, flush joint, PVC pipe with a nominal 2-inch diameter. Well risers will conform to the requirements of ASTM-D 1785 Schedule 40 pipe and NSF Standard 14 PVC, and will be clearly identified as such.

Screen. The well screens will be a minimum of 10 feet long and will be constructed of ink-and printing-free PVC material similar to the well riser. The screens will be non-contaminating, factory-constructed, continuous wrap or mill-slot design, with a slot size of 0.010 inch to minimize the volume of silt and sand entering the well. This slot size is compatible with the results of the sieve analysis of existing wells shown in Appendix C of the RI Report. The mean grain size for the samples from the Fluvial Aquifer ranged from 0.0075 to 0.11 inches, with most samples in the range of 0.012 to 0.032 inches. Most of the wells had a coefficient of uniformity less than three and a curvature of less than two. The screens in the existing wells are also of the same slot size. The wells have functioned satisfactorily. A 20/40 filter pack will be used in the well installations. This screen and filter pack combination will minimize the sediment entering the well, while allowing adequate flow for rapid purging and sampling of the monitor wells.

Screen Location. Wells will be constructed so that base of the screen is near the top of the confining unit between the Fluvial and Memphis Sand aquifers. The proposed screen length is 10 feet. The placement of well screens near the base of the Fluvial Aquifer is consistent with the nature of the contaminants of concern. Floating constituents have not been encountered and are not expected during this project. None of the contaminants of concern occur or are expected to occur as a floating product or dense layers within the aquifer.

Joining Screen and Riser. Screen and riser sections will be joined by threaded, flush-joint couplings to form watertight unions that retain 100 percent of the strength of the screen. Solvent glue will not be used at any time con construction of the wells. The bottom of the deepest screen or casing section will be sealed with a threaded cap or plug of inert, non-corroding material similar in composition to the screen.

Well Plumbness and Alignment. All risers and screens will be set plumb and true to line. The monitoring well screen and riser pipe will be held in the center of the hole by the augers during the installation of the annular materials. Centralizers will be used where necessary to calculate plumbness and alignment of the wells (generally for wells that exceed 80 feet in depth). Centralizers will not be attached to the well screen. The lowest centralizer attachment will be a minimum of 10 feet above the top of the well screen.

Filter Pack. Silica sand will be used as the filter pack material. Only clean, inert silica sand of 20/40 or similar gradation will be used to construct a uniform and continuous filter pack. This filter pack is slightly finer than would be typically used in material with the reported grain size distribution of the Fluvial Aquifer. However, this difference will not alter the well efficiency and will provide an effective connection with the aquifer. The pack will be designed to prevent migration of fines into the screen. The existing wells are constructed of similar-sized material. The filter pack will be placed by tremie pipe from the base of the boring to approximately 2 feet above the well screen. If the boring penetrates the confining layer, bentonite will be used to backfill the portion of the confining layer penetrated by the auger.

Bentonite Seal and Grout. A minimum 5-foot bentonite pellet seal will be placed into the annular space between the riser and the boring wall at the top of the filter pack. The bentonite pellet seal will be a minimum 30% solids pure bentonite material. The bentonite will be tremied in place to prevent "bridging." A bentonite grout mixture, consisting of a coarse-grained, high solids bentonite grout of at least 20 percent solids pure bentonite (Baroid Benseal, American Colloid, Volclay, or equal), will be placed from the top of the bentonite seal to within 2 feet of ground surface. The grout will contain a minimum of 20 percent solids and be mixed in the field with potable water in accordance with manufacturer's specifications.

Protection of Well and Surface Completion. Precautions will be taken to prevent tampering with monitoring wells or the entrance of foreign material into the well. Upon the completion of each well, a vented cap will be installed to prevent material from entering the well. A protective steel casing will be placed around the well riser. The steel casing will be equipped with a cap and lock and will be between 24 inches and 36 inches above ground level. It will be taller than the enclosed well. Depending on the location, wells may be set in a protective casing much closer to the ground (flush-mounted). At a minimum, a 4-foot-square, 6-inch-thick concrete pad will be constructed around the protective casing at ground level and sloped away from the well. The portion of the pad around the well will be set a minimum of 3 inches in the ground. Four, 2-inch or larger diameter steel posts will be equally spaced around the protective casing and embedded in the concrete pad. There will be no openings in the protective casing wall below its top. The top of the well riser, as opposed to the well casings, will be notched on the north side, which will be the point where the elevation is established. The elevation will be to the closest 0.01 foot. All outside casing will be permanently identified with the well number. A survey marker will be permanently placed in each pad. Protective casings and steel posts will be primed and painted with two coats of traffic yellow paint.

Temporary Capping. Any well that is to be temporarily removed from service, or left incomplete because of delay in construction, will be capped with a watertight cap and equipped with a vandal-proof cover.

4.12.3.6 Field Logs

The field geologist or geotechnical engineer will maintain suitable field logs detailing drilling and well construction activities. Field logs will be faxed to CEHNC not later than 0800 hrs, central standard time, on the day after the completion of the subsurface sampling event.

Final Logs. Photocopies of the original field logs will be included in an Appendix of the final report. Additionally, the field logs will be edited (for spelling and grammar) and drafted for inclusion into the final report. Information provided in the logs will include the following

- reference point for all depth measurements;
- depth of each change of stratum;
- thickness of each stratum;
- identification of the material of which each stratum is composed according to the Unified Soil Classification system, or standard nomenclature, as necessary;
- depth interval from which each formation sample was taken, and condition of sample (such as wet or dry);
- depth at which hole diameter (bit sizes) change;
- depth at which groundwater is first encountered;
- depth to the static water level;
- total depth of completed well;
- depth or location of loss of drilling fluids (if used);
- location of any fractures, joints, faults, cavities, or weathered zones;
- depth and thickness of grouting or sealing;
- nominal hole diameters;
- amount of cement used for grouting or sealing;
- depth and type of well casing;
- description (to include length, location, diameter, slot sizes, material, and manufacturer) of well screen(s);
- any sealing-off of water-bearing strata;
- static water level upon completion of the well and after well development;
- drilling date or dates;
- construction details of monitoring well; and,
- well development notes.

4.12.3.7 Well Development

After each well has been constructed, but no sooner than 48 hours after grouting is completed, the well will be developed by pumping or surging, without the use of acids, dispersing agents, or explosives. Development will continue for a minimum of four hours or until groundwater removed from the well is clear and free of sand and drilling fluids, and parameters (such as pH, temperature, and conductivity) are stabilized to less than 5 percent fluctuation between three successive readings.

4.12.3.8 Decontamination Procedures

A stringent decontamination and inspection program will be followed to prevent the introduction of any contaminants into the subsurface during drilling. A decontamination area for the cleaning of drilling equipment will be set up away from the drill site. After cleaning and decontaminating, all drilling equipment and sampling tools will remain off the ground on metal racks, metal sawhorses, or plastic sheeting until ready for use.

After the soil has been analyzed, if the analysis shows CWM or CWM breakdown products, the following decontamination steps will be taken for all equipment:

- Wash with 5% sodium hypochlorite solution (a brush may be used to remove particulates),
- Rinse with tap water,
- Rinse with de-ionized water,
- Rinse with pesticide grade isopropanol,
- Rinse with organic free water,
- Air dry, and
- Wrap with aluminum foil.

If the soil analysis does not show the presence of CWM or CWM breakdown products, the following decontamination steps will be taken:

Drill Rig and Tools. All the drilling rigs and drilling equipment will be steam-cleaned in the designated cleaning/decontamination area before entering the drill site. In addition, all downhole drilling, sampling, and associated equipment will be cleaned and decontaminated by the following procedure between each borehole:

- Steam clean using a steam cleaner with soap capable of generating a pressure of at least 2,500 pounds per square inch (psi) and producing a steam of at least 20°C. All equipment that is hollow or that has holes to transmit water or drilling fluids will be cleaned inside and outside with soap.
- Rinse with potable tap water.
- Rinse with de-ionized water from a stainless steel container (can not be an hand sprayer).
- Rinse with pesticide grade isopropanol from a stainless steel container (can not be an hand sprayer).
- Air dry.
- Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported.

All cleaning and decontamination will be conducted in a designated area lined with heavy-duty plastic. A catch basin will be used or constructed to contain all runoff until it can be placed into containers. The cleaning of drilling equipment (drill pipe, auger, and tools) will be conducted above the plastic sheeting on saw horses or other appropriate means.

All of the drilling equipment, including the drill rig, will be inspected before entering the site to monitor whether there are fluids leaking and whether all gaskets and seals are intact. No oil or grease will be used to lubricate drill stem threads or any other drilling equipment being used over the borehole or in the borehole without prior approval

Soil Sampling Equipment Decontamination. All the soil sampling equipment not associated with the drill rig and drilling will be decontaminated by personnel wearing disposable latex gloves or vinyl gloves and using the following procedure:

- Wash with tap water and laboratory grade, non-phosphate detergent, using a brush if necessary to remove particulate matter and surface films.
- Rinse with tap water.
- Rinse with de-ionized water.
- Rinse twice with pesticide grade isopropanol (can not be an hand sprayer)..
- Rinse with organic-free water (not deionized or distilled water and can not be an hand sprayer).
- Air dry.
- Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported.
- Water used in decontamination operations will be disposed of as a purge water.

Groundwater Sampling Equipment Decontamination. With the following exceptions, all groundwater sampling will be conducted with disposable sampling equipment (such as disposable bailers and disposable rope) that requires no decontamination.

Elevation tapes will be decontaminated using the following procedure:

- Wash with tap water and laboratory grade, non-phosphate detergent, using a brush if necessary to remove particulate matter and surface films.
- Rinse with tap water.
- Rinse with de-ionized water.
- Air dry.
- Wrap with aluminum foil, or seal in plastic bag.

Submersible pumps and hoses used to purge groundwater wells will be decontaminated using the following procedures:

- Flush the hose using laboratory grade, non-phosphate detergent, followed by scrubbing the exterior of the hose with a brush.

- Rinse the exterior of the hose with tap water followed by pumping tap water through the hose.
- Rinse the exterior of the hose and pump with de-ionized water.
- Place equipment in a polyethylene bag to prevent contamination.

4.13 CALIBRATION PROCEDURES

4.13.1 Field Instruments

Field instruments will be calibrated daily prior to sampling activities. Standards used to calibrate the field instruments will be traceable to NIST Standards. The method and frequency of calibration for the instruments used for each field activity are described in this section.

4.13.1.1 HNu Calibration

The meter will be calibrated according to manufacturer's instructions. The manufacturer will be contacted regarding recommendations for the most appropriate calibration procedure to be used for the contaminants of interest. General instructions are included in the SSHP. On a daily basis, the meter will be calibrated to isobutylene. The HNu will be zeroed to background levels each hour and at each new location. Calibration records will be kept in the field log book by field personnel.

4.13.1.2 Organic Vapor Analyzer Calibration

The primary calibration of the OVA is performed at the factory to 100 parts per million (ppm) methane gas. Secondary calibration will be performed according to manufacturer's specifications at the beginning of each sampling activity. Those specifications are included in the SHSP. In addition, the manufacturer will be contacted regarding recommendations for the most appropriate calibration procedure to be used for the contaminants of interest. The meter will be zeroed to background levels on a daily basis by field personnel.

4.13.1.3 Soil Boring Drilling

While drilling either borings or wells, an OVA or an HNu will be used to screen the soil samples and to monitor the ambient air. The calibration procedures outlined in above will be followed during the soil boring activities.

4.13.1.4 Groundwater Sampling

Several instruments will be used during the collection of groundwater samples. Initial monitoring of the ambient air for the volatile organic vapors around the wellhead will be performed using an HNu meter. The meter will be calibrated with isobutylene each day and will be zeroed to ambient air at each well location before opening the well. During well evacuation, pH and specific conductance will be measured. The meters will be calibrated in the field before use at each well, following manufacturer's specifications. The calibration procedures are described below and will be carried out by field personnel.

4.13.1.5 pH Meter Calibration

The pH meters will be calibrated against two sets of standard pH solutions, either 4.0 standard units (SU) and 7.0 SU or 7.0 SU and 10.0 SU, depending on whether previous pH measurements have been less than or greater than 7.0 SU, respectively. At the end of calibration, the meter readings will be adjusted and the probe will be rinsed thoroughly with distilled water.

4.13.1.6 Specific Conductivity Meter Calibration

The specific conductivity meters will be standardized by immersing the decontaminated conductivity probe into a standard solution of conductivity buffer. The conductivity of the standard solution will be within the same order of magnitude as the water sample. The meter reading will be manually adjusted to the buffer solution value. After calibrating, the probe will be triple rinsed with distilled water.

4.13.2 Laboratory Equipment

The contracted laboratory will provide the project chemist and QA supervisor with a copy of the appropriate Comprehensive Quality Assurance manual (CompQAM) for review and approval. The Laboratory CompQAM will outline in detail procedures for instrument calibration control.

4.14 ANALYTICAL PROCEDURES

Samples will be analyzed using EPA-approved methods. Before the field effort begins, the analytical laboratory will provide the lead chemist with a copy of its CompQAM for review and approval.

4.14.1 Data Packages

Level 1 and 2 data packages are detailed in Section 3.2.2 of the QAPP. Level 3 data packages are summarized in Table 4.3. Level 4 deliverables are the same as Level 3 with the addition of all the unreduced analytical data. The forms listed below may not apply to all methods analyzed, but the information for all applicable forms will be provided.

4.14.2 Reporting Limits

Method target compound lists and reporting limits are summarized in Table 4.5. Because of the use of similar analytical techniques for Levels 2 and 3, the target reporting limits presented in Table 4.5 are applicable for both data quality levels.

4.15 DATA QUALITY EVALUATION

4.15.1 Level 1 - Field Survey Data

4.15.1.1 Field instruments used to collect temperature, pH, and conductivity are direct reading, thus there are no field calculations or data reduction necessary. All field data will be recorded in the site log books by appropriate trained field personnel. Field data will include the following:

- Instrument identification

- Calibration information (standards used, standard expiration dates and results)
- Date and time of calibration and sample measurement
- Sample results
- Supporting information (for example, temperature for pH reading)

4.15.1.2 All field data will be collected, reviewed, and verified by the FTL while in the field. Data initially will be accepted or rejected by the FTL before leaving the sampling site. Extreme readings (readings that appear significantly different from other readings at the same site) will be accepted only after the instrument has been checked for malfunction and the readings verified by retesting. In addition, extreme or spurious readings will be recorded in the field log book, along with the rationale for accepting or rejecting the data.

4.15.1.3 Field documentation, sample data, instrument calibrations, and QC data will be reviewed by the PM (or a designee) before being included in the project files. QC checks will be reviewed by the project chemist, as well.

Table 4.3
Level 3 Data Package Deliverables
Defense Depot Memphis, Tennessee

CLP-Like Form	Purpose
Organics	
1	Data summary form
2	Surrogate spike recovery
3	MS/MSD & LCS recoveries
4	Method blank summary
6D	Initial calibration retention time summary
7E	Continuing calibration summary
8C	Analytical sequence - evaluation of retention time shift for the internal standard
10	Compound identification summary
Metals	
1	Data summary form
2	Initial and continuing calibration verification
3	Blanks
4	ICP Interference check samples
5A	Spike sample recovery
5B	Post-spike sample recovery
6	Duplicates
7	Laboratory control sample
8	Method of standard addition results
9	ICP serial dilution results
10	Instrument detection limit
11A & B	ICP inter-element correction factors (annually)
12	ICP linear ranges (quarterly)
13	Preparation logs
14	Analysis run logs

Table 4.4
Project Reporting Limits
Defense Depot Memphis, Tennessee

Compound/Analyte	Water	Soil
Organics	(µg/L)	(mg/kg)
1,4-Oxathiane	0.6000	0.8560
1,4-Dithiane	0.3000	1.4700
	(µg/L)	(µg/kg)
Thiodiglycol	2.0000	500
	(µg/L)	(mg/kg)
HMX	1.25	2.2
RDX	0.84	1.0
1,3,5-TNB	0.26	0.25
1,3-DNB	0.11	0.25
Tetryl	1.25	0.65
NB	1.25	0.26
2,4,6-TNT	0.11	0.25
4-Am-DNT	0.060	1.25
2-Am-DNT	0.035	1.25
2,6-DNT	0.31	0.26
2,4-DNT	0.020	0.25
2-NT	1.25	0.25
4-NT	1.25	0.25
3-NT	1.25	0.25
Inorganics	(µg/L)	(µg/kg)
Aluminum - ICP	200	40,000
Antimony - ICP	60	12
Barium - ICP	200	40,000
Beryllium - ICP	5	1
Cadmium - ICP	5	1
Calcium - ICP	5,000	1,000,000
Chromium - ICP	10	2
Cobalt - ICP	50	10,000
Copper - ICP	25	5
Iron - ICP	100	20,000

Table 4.4 - continued
Project Reporting Limits
Defense Depot Memphis, Tennessee

Compound/Analyte	Water	Soil
Magnesium - ICP	5,000	1,000,000
Manganese - ICP	15	3,000
Mercury - CVAA	0.2	0.1
Nickel - ICP	40	8
Potassium - ICP	5,000	1,000,000
Silver - ICP	10	2
Sodium - ICP	5,000	1,000,000
Vanadium - ICP	5,000	1,000,000
Zinc - ICP	20	4

Table 4.5
Field Equipment Preventive Maintenance
Defense Depot Memphis, Tennessee

Instrument	Activity	Frequency
pH meter	Battery replacement or electrode cleaning	As needed (indicated by LCD display) or as specified in the instrument manual.
Conductivity Meter	Battery replacement or probe cleaning	As needed (indicated by LCD display) or as specified in the instrument manual.

4.15.2 Level 2 - Field Screening Data

The field analysis will consist of CWM screening performed by ERDEC prior to samples being released to the laboratory. Samples showing indications of CWM will not be sent to the laboratory. All ERDEC data will be sent to Parsons ES upon completion of the project to include the results in the report.

4.15.3 Levels 3 and 4 - Laboratory Analyses

All Level 3 and 4 data will undergo a data quality evaluation by the Parsons project chemist. The details of the evaluation processes are in Sections 8.3 and 8.4 of the DDMT Generic QAPP.

4.16 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The final activity of the data quality evaluation is an assessment of whether the data meets the DQOs. A discussion of all data quality measures can be found in Sections 8.5 and 11 of the DDMT Generic QAPP.

4.17 PERFORMANCE AND SYSTEM AUDITS

The laboratory QA officer will carry out performance and/or systems audits to insure that data of known and defensible quality are produced during the program.

4.17.1 System Audits

Systems audits are qualitative evaluations of components of the laboratory quality control measure systems. They determine if the measurement systems are being used appropriately. The audits may be carried out before all systems are operational, during the laboratory program, or after the completion of the laboratory program. Such audits typically involve a comparison of the activities given in the QA/QC Plan with activities actually scheduled or performed. A special type of systems audit is the data management audit. This audit addresses only data collection and management activities.

4.17.2 Performance Audits

4.17.2.1 The performance audit is a quantitative evaluation of the measurement systems of a program. It requires testing the measurement systems with samples of known composition or behavior to evaluate precision and accuracy. The performance audit is carried out by or under the auspices of the laboratory QA Officer without the knowledge of the analyst.

4.17.2.2 The laboratory QA Officer is responsible for evaluating the accuracy and precision of the analytical data. Based on this evaluation, the laboratory QA Officer will implement corrective actions as necessary to ensure that reliable data is obtained.

4.18 PREVENTIVE MAINTENANCE

4.18.1 Field Instruments

All equipment used by Parsons will be maintained in accordance with the manufacturer's instructions. Preventive maintenance activities for field equipment are listed in Table 4.5. Routine maintenance activities for field equipment repairs will be documented in the site log book. Whenever a piece of equipment fails to operate properly, the instrument will either be repaired in-house (if possible) or will be sent out for repairs and another instrument equivalent to the original will be substituted.

4.18.2 Analytical Laboratory Instruments

Preventive maintenance for laboratory instruments is discussed in detail in the laboratory CompQAM.

4.19 DATA QUALITY INDICATORS

A discussion of the QC measures used for Data Levels 2, 3, and 4 is presented in Section 11 of the Generic QAPP. Also included in Section 11 are the formulas for calculating the accuracy, precision, and completeness of the data.

4.20 CORRECTIVE ACTION

4.20.1 Field Activities Corrective Actions

The Parsons ES QA/QC Officer is responsible for implementing corrective actions for field work. The laboratory QA Officer will be responsible for implementing laboratory corrective actions. The need for corrective actions, if any, will be determined by periodic audits as previously discussed. The corrective actions implemented, if any, will be documented in the field log book or laboratory files, as applicable.

4.21 QUALITY ASSURANCE REPORTS

The Engineering Evaluation/Cost Analysis (EE/CA) report will include a separate QA section which summarizes data quality information collected throughout the duration of this project.

4.22 SAMPLE REPORT MANAGEMENT

4.22.1 Laboratory Submittals

4.22.1.1 As a minimum, the laboratory report will show traceability to sample analyzed, and will contain the following information:

- Name of report;
- Date of report preparation;
- Laboratory name, address, and telephone number;
- Sample ID number;
- Name of sample;
- Type of sample (water, soil, etc.);
- Analyses performed;
- Initial sample volume for analysis;
- Final sample volume (after extraction) for analysis;
- Type of extraction performed (including method number);
- Date of sampling;
- Date sample was received;
- Date extractions/analyses were performed;
- Applicable laboratory blank results;
- Applicable surrogate standard recoveries and the respective QC Limits;

- Sample detection limits for each compound;
- Sample dilution factors;
- Quality control check sample summaries including percent recoveries, relative percent differences, and respective QC Limits;
- Calibration and instrument tuning performance summaries;
- Appropriate Chain-of-Custody;
- Completed Cooler Receipt Form including temperature information;
- Completed Case Narrative documenting any anomalies associated with the sample analyses.

4.22.1.2 Project name and ID number will appear on the Chain of Custody Record. All soil samples will be reported on a dry weight basis with percent moisture reported.

4.22.1.3 These data requirements will be included in the raw data submittal as well as in electronic form.

4.22.2 Data Report Submittals

The data report submitted by Parsons ES will include the following information:

- Sample IDs, including data collected;
- Validated sample results (at detected concentration or as less than the specific quantitation limits);
- Internal quality control results (lab blanks, surrogate spikes, duplicates, spike sample results);
- Cross reference table matching sample IDs to QC sample Ids (including field duplicates, equipment rinsate blanks, and field blanks);
- Discussion of the data validation findings, including all non-complaint results and definitions of data qualifiers used.

TAB

5

SECTION 5
INVESTIGATION DERIVED WASTE PLAN

In the following sections, the disposal of derived wastes is discussed.

5.1 PURGED/DEVELOPMENT WATER AND DECONTAMINATING FLUIDS

Development and purged water along with decontamination fluids will be collected and stored. A composite sample of the containerized water will be analyzed. The analytical results of the composite sample will be used for the characterization of the waste. The discharge will be conducted in accordance with the DDMT industrial discharge permit application (currently being applied for). The processed water will be collected in a storage tank for disposal to the City of Memphis sanitary sewer system (consistent with the permit). Solids will be allowed to settle out of the water before being transferred to the treatment system.

5.2 STORAGE, ANALYSIS, TREATMENT, AND DISPOSAL OF INVESTIGATION-DERIVED WASTES

All monitoring well and soil boring cuttings will be collected and placed in DOT-approved drums or in a rolloff. A label will be affixed to each drum clearly indicating the boring number and depth interval from which the cuttings originated. The site geologist will maintain a log detailing the disposition of cuttings from each hole. The drums will be stored in a location at Dunn Field as specified by DDMT pending the results of the chemical analysis which will determine the disposition of the contents.

5.2.1 Soil Waste

5.2.1.1 Analytical sample results from the investigation will be reviewed to evaluate whether any of the soil waste might exceed TCLP criteria. Upon completion of the data evaluation, a letter report will be submitted to DDMT detailing the drums that contain cuttings that are non-hazardous and may be disposed of on-site as fill. This report will also detail those drums containing cuttings that should be considered hazardous waste (HW). The report will identify options for treatment and disposal of the HW in accordance with applicable federal and State of Tennessee regulations. The contents of the drums will be identified with a composite representative analytical sample. However, first the drums will be sampled and analysis conducted by the ERDEC mobile laboratory prior to shipping to the environmental laboratory. Of particular concern are cuttings with metals (primarily arsenic, chromium, and lead) contamination. The RI Report reported widespread occurrence of metals concentrations in both surface and subsurface soils. A number of these samples were obtained from areas with no known source of metals contamination.

5.2.1.2 Soil and cuttings from the decontamination operations will be collected in drums. The site geologist will record the well number(s) from which decontamination sediments were added to the drum. Labeling and handling of the drums from decontamination will follow the same procedures as the drums of drill cuttings.

5.2.2 Classification and Disposal of Soil Waste

If the analysis of a soil sample indicates that organic compounds or metals exceed either federal or state TCLP limits (whichever is more stringent), then the drum(s) associated with that sample will be considered HW and will be disposed in accordance with federal and state requirements. Drums containing cuttings that were recommended to be considered non-hazardous will be disposed only upon specific written instructions from DDMT.

5.2.3 Personal Protective Equipment and Disposable Equipment Waste

All disposable personal protective equipment (PPE) waste (gloves, coveralls, decontamination supplies, protective coverings, respirator canisters, booties, and splash suits) and disposable equipment (DE) waste (plastic ground and equipment covers, Teflon® tubing, conduit pipe, and aluminum foil) used during the study will be collected and double bagged. PPE and DE wastes are generally classified as non-hazardous wastes and will be disposed in dumpsters at DDMT.

TAB

6

SECTION 6
WORK, DATA, AND COST MANAGEMENT PLAN

The Work, Data and Cost Management Plan (WDCM) defines the project objectives, identifies key personnel and their responsibilities and outlines a schedule for implementing the project.

6.1 PROJECT OBJECTIVES

The objectives of this project are listed below.

A. To determine if CWM, OE, degradation products, or decontamination constituents are present and are migrating from the burial sites.

B. To characterize the extent and model the volume of CWM/OE contamination in order to assess and recommend removal action.

C. To develop a removal action plan that satisfies the EPA, State, Federal Government, and public concerns.

D. To provide location specific clearances for units within the suspect areas in order to facilitate progression of RI/FS investigations.

E. Prepare a quantitative human risk assessment and a qualitative ecological risk assessment for the site (optional).

F. To devise and compare feasible alternative actions including a no action alternative (optional).

G. To prepare an EE/CA that recommends and justifies appropriate preferred OE Removal Alternatives (optional).

6.2 PROJECT TEAM

Figure 6.1 presents an organization chart for the project team.

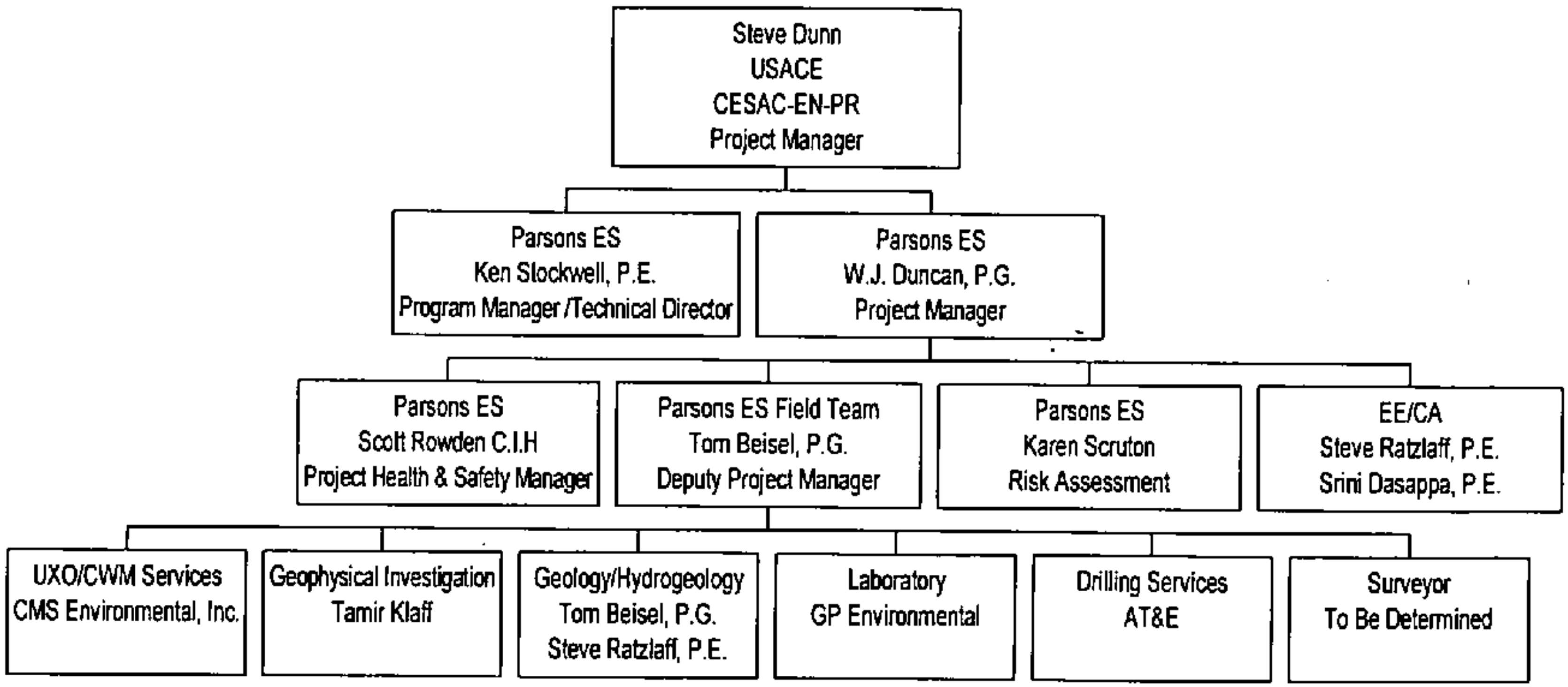
6.3 SCHEDULE

Figure 6.2 presents a project schedule.

6.4 UNDERSTANDING THE SCOPE OF WORK

Suspected Ordnance and Explosive (OE) contamination exists on Dunn Field which poses a safety hazard in that unexploded ordnance (UXO), chemical warfare material (CWM), and other chemicals associated with the Chemical Warfare Service may be

Figure 6.1
Technical Team
EE/CA For Areas A and B, OU1
Defense Distribution Depot Memphis
Memphis, Tennessee



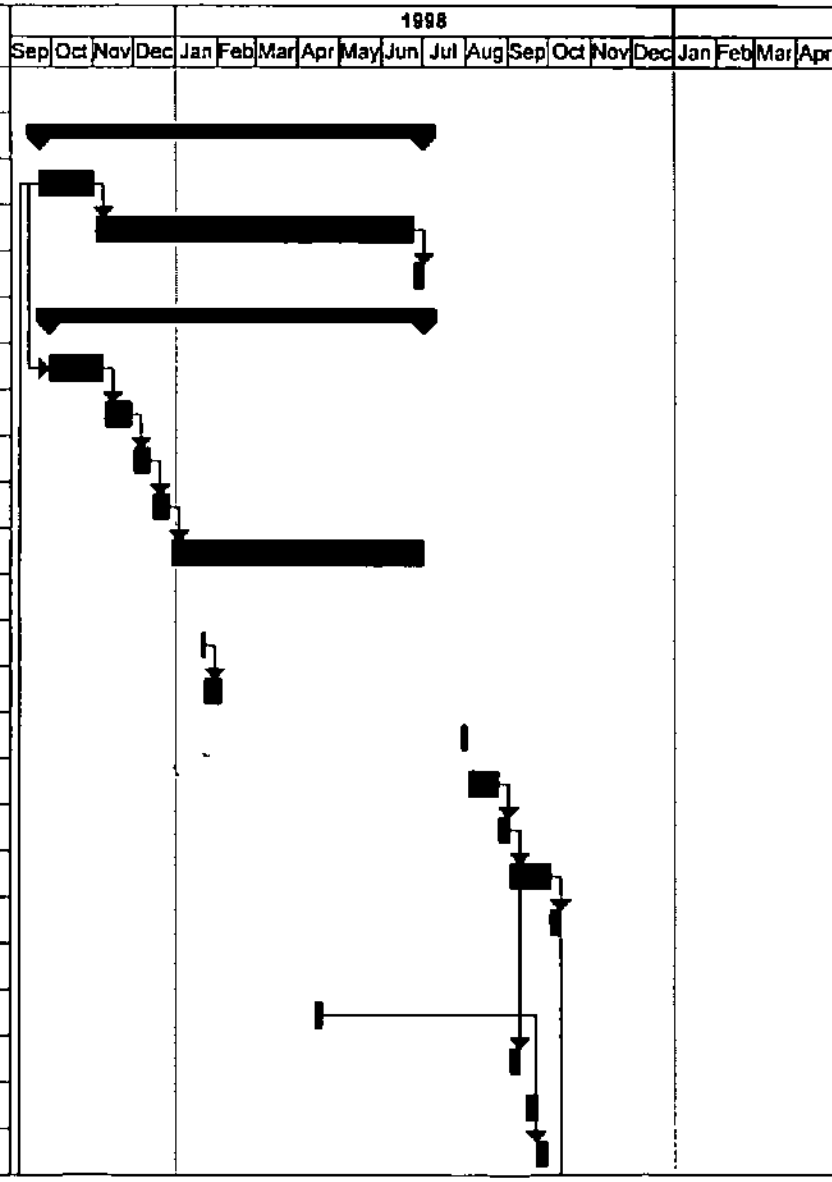
327 95

i:\732283\plans\team.ppt

Figure 6-2

Defense Distribution Depot Memphis, Tennessee

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Task 1 Work Plans**	202d	9/22/97	6/30/98	
2	Work Plan	202d	9/22/97	6/30/98	
3	Draft Work Plan	30d	9/22/97	10/31/97	
4	Government Review	167d	11/3/97	6/23/98	3
5	Final Work Plan	5d	6/24/98	6/30/98	4
6	Site Safety Plan	197d	9/29/97	6/30/98	
7	CSW SS Draft	30d	9/29/97	11/7/97	3SS+5d
8	Government Review	15d	11/10/97	11/28/97	7
9	Final SS Draft	10d	12/1/97	12/12/97	8
10	Government Review	10d	12/15/97	12/26/97	9
11	Final SS	132d	12/29/97	6/30/98	10
12	**Task 2 Site Characterization**	188d	1/20/98	10/8/98	
13	Mobilization/Demobilization	2d	1/20/98	1/21/98	
14	Geophysics - Phase I	8d	1/22/98	2/2/98	13
15	Geophysics - Phase II	3d	7/29/98	7/31/98	
16	Well Installation and Dvlpmnt	16d	8/3/98	8/24/98	
17	Well Sampling	6d	8/25/98	9/1/98	16
18	Lab Analysis	22d	9/2/98	10/1/98	17
19	Validation	5d	10/2/98	10/8/98	18
20	**Task 3 Letter Reports**	118d	4/13/98	9/21/98	
21	Geophysical	5d	4/13/98	4/17/98	
22	IDW	5d	9/2/98	9/8/98	17
23	Analytical	6d	9/14/98	9/21/98	
24	**Task 4 IDW Disposal**	6d	9/21/98	9/28/98	21

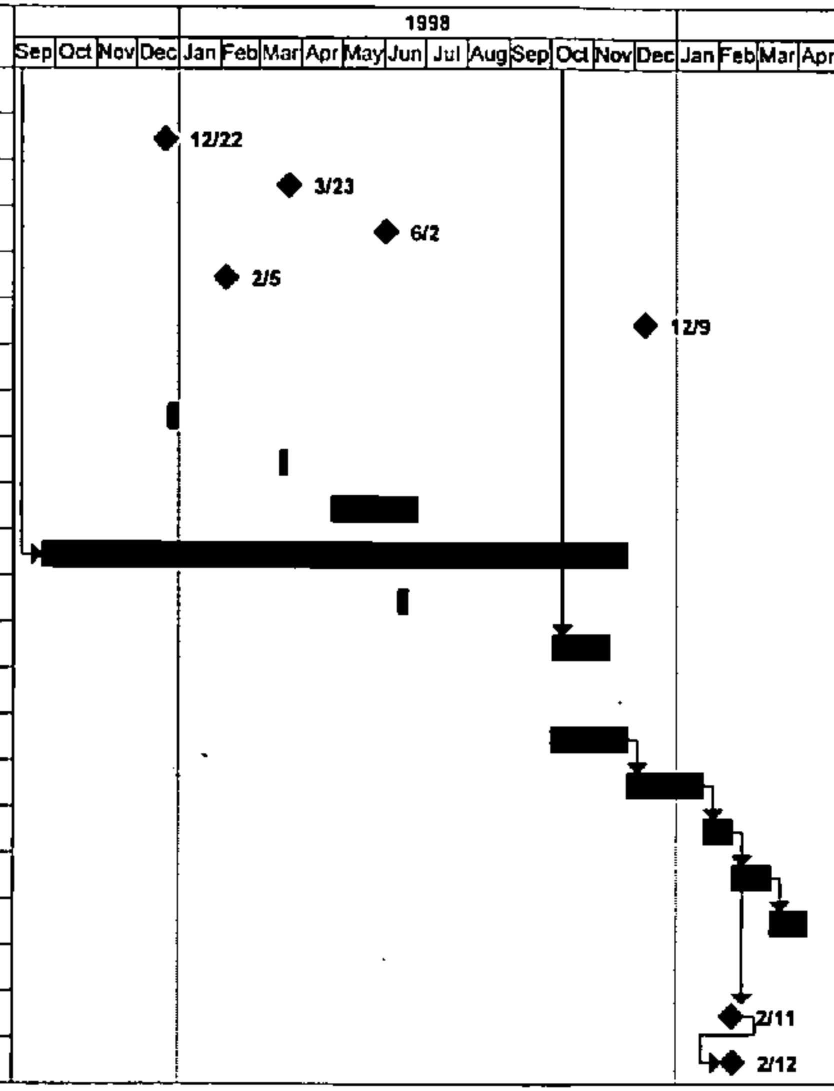


I:\732283\wtp\I:\732283\PLANS\WTP\SCHEDULE.MPP
DDMT Schedule
Page 1 of 2

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

Defense Distribution Depot Memphis, Tennessee

ID	Task Name	Duration	Start	Finish	Predecessors
25	**Task 5 Meetings**	263d	12/22/97	12/9/98	
26	RAB 1	1d	12/22/97	12/22/97	
27	RAB 2	1d	3/23/98	3/23/98	
28	RAB 3	1d	6/2/98	6/2/98	
29	Review	1d	2/5/98	2/5/98	
30	Review	1d	12/9/98	12/9/98	
31	**Task 6 Video Tape**	131d	12/24/97	6/24/98	
32	1	5d	12/24/97	12/30/97	
33	2	5d	3/16/98	3/20/98	
34	3	9w	4/23/98	6/24/98	
35	**Task 7 Project Management**	61.6w	9/22/97	11/25/98	3SS
36	**Task 8 Survey**	5d	6/11/98	6/17/98	
37	**Task 9 Risk Assessment**	30d	10/2/98	11/12/98	18
38	**Task 10 Prepare EE/CA**	135d	10/1/98	4/7/99	
39	Draft	40d	10/1/98	11/25/98	
40	Review	40d	11/26/98	1/20/99	39
41	Draft Final	15d	1/21/99	2/10/99	40
42	Review	20d	2/11/99	3/10/99	41
43	Final	20d	3/11/99	4/7/99	42
44	**Task 11 Action Memo**	2d	2/11/99	2/12/99	
45	Draft TBD	1d	2/11/99	2/11/99	41
46	Final TBD	1d	2/12/99	2/12/99	45



327 97

I:\732283\wtp\I:\732283\PLANS\WTP\SCHEDULE.MPP
ODMT Schedule
Page 2 of 2

Task		Rolled Up Task	
Progress		Rolled Up Milestone	◇
Milestone	◆	Rolled Up Progress	
Summary			

beneath the site or be on the ground surface. The UXO and CWM may constitute an imminent danger. The US Army needs to evaluate alternative means of addressing the safety and health problems pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104, and the National Contingency Plan (NCP) Sections 300.120 (c) and 300.400 (e). The CEHNC will supply final reports to Parsons ES including data and information gathered from previous sampling activities. This information will be the basis for preparing the OE Characterization Report and Cost Analysis. OE sampling is not a component of this scope of work.

6.5 TASKS AND DELIVERABLES

The following section presents the technical approach that Parsons ES will follow to complete the project.

6.5.1 Perform Site Characterization

6.5.1.1 Site characterization activities to be performed at Dunn Field will follow the procedures and objectives described in the Scope of Work and in the Work Plan. Investigation activities to be performed include a geophysical survey, surface and subsurface soil sampling and analysis, soil boring and monitoring well installation, and sampling and analysis of water samples.

6.5.1.2 A video tape of each activity performed during the Site Characterization will be prepared and submitted as part of the Engineering Report. The location of site characterization activities such as sampling will be surveyed and mapped by a Tennessee registered land surveyor.

6.5.2 Data Management

6.5.2.1 Data collected with each of the geophysical instruments will be post-processed in the field after downloading. Post-processing will primarily involve ensuring that survey lines were correctly recorded with respect to their survey direction, distance, and grid coordinates. After post-processing and data-checking is complete, the geophysical data will be processed into an ASCII delimited file. The data will then be input into a mapping software package (Surfer® for Windows or comparable) and the locations and magnitudes of the geophysical signals will be plotted on a plan-view map. Final versions of the data and output files shall be compatible with Intergraph Microstation. Both electronic and hardcopy versions will be delivered to CEHNC.

6.5.2.3 Level 1 and 2 analytical data data packages on groundwater and soil samples are detailed in Section 3.2.2 of the QAPP. Level 3 data packages are summarized in Table 4.3. Level 4 deliverables are the same as Level 3 with the addition of all the unreduced analytical data.

6.5.3 Letter Reports

6.5.3.1 Data gathered during the field effort will be presented in the form of letter reports. The letter reports to be prepared include the following:

1. Analytical Letter Report,
2. IDW Letter Report, and
3. Geophysical Report of Field Data.

6.5.3.2 The Analytical Letter Report will summarize the findings of the soil and groundwater sampling. The IDW Letter Report will identify the location and number of IDW containers, analytical information and identify disposal options. The Geophysical Report will provide the data gathered during the geophysical investigation.

6.5.4 IDW Disposal

IDW generated during the field effort will be disposed of at the direction of the Contracting Officer. IDW containers will be located, secured, labeled, and sampled and analyzed in accordance with the Work Plan and the Generic Quality Assurance Project Plan.

6.5.5 Meetings and Public Involvement

Parsons will provide a minimum of two team members familiar with the project to attend or give a presentation at a minimum of five meetings. The meetings will be held at DDMT with the Restoration Advisory Board (RAB) or at Huntsville.

6.5.6 Perform Risk Assessment

An evaluation of site risks will be performed using the EPA Risk Assessment Guidance for Superfund (RAGS). The results will be included in the EE/CA Report discussion of overall site risks.

6.5.7 Prepare EE/CA Report

The EE/CA report will fully discuss the field work and subsequent evaluations and recommendations. Alternative plans are to be developed to address the project objects. The alternatives and their evaluations will be presented in the EE/CA Report.

6.6 PROJECT MANAGEMENT AND REPORTING

6.6.1 The project manager is responsible for issuing the following documents throughout the project:

1) Meeting Minutes (due 10 calendar days after a meeting);
2) Record of Telephone Conversations (due 5 days after a conversation);
3) Master Schedule (submitted with this document); and

4) Monthly Progress Reports.

6.6.2 A monthly progress report will be issued pursuant to the terms of the contract. The monthly progress report will include a summary of the work performed during the reporting period as well as the work that is planned to be performed in the upcoming period. The report will summarize the results of meetings and telephone conversations that occurred during the reporting period.

TAB

7

SECTION 7
ENVIRONMENTAL RESOURCES PROTECTION PLAN

This Environmental Resources Protection Plan (ERPP) has been prepared for the Engineering Design at Dunn Field located at the Defense Distribution Depot Memphis, Tennessee(DDMT). The purpose of the ERPP is to ensure compliance with the National Environmental Policy Act (NEPA) and Army Regulation (AR) 200-2 such that proposed activities at the site avoid or minimize potential adverse environmental impacts.

7.1 SITE LOCATION

7.1.1 The DDMT is located within the city limits of Memphis, Tennessee in southwest Tennessee (Figure 1.1), approximately 8 miles east of the Mississippi River and 6 miles north of the Tennessee-Mississippi State line (USATHAMA, 1982). DDMT consists of approximately 642 acres and is comprised of the main depot, Dunn Field (a bulk mineral storage/historic waste disposal area), military housing, and outdoor recreational facilities. The investigation site is located at Dunn Field.

7.1.2 Dunn Field is located north of the main depot consisting of approximately 30 acres of open field currently used for bauxite storage. Based on information obtained from depot records and interviews with former depot military personnel, OE and CWM have been buried in trenches and or pits located in Dunn Field.

7.2 FIELD ACTIVITIES INVOLVING ENVIRONMENTAL RESOURCES

The field investigation is designed to determine if CWM, OE, degradation products, or decontamination constituents are present and are migrating from the burial sites. The current plan does not include field investigations at areas of potential impact where public activities may occur, and where sensitive natural and historic environments may exist.

7.2.1 VEGETATIVE SPECIES REMOVAL

7.2.1 The Engineering Design field investigation will include brush clearing involving perennial species (1 inches in diameter or smaller). This action is required to operate and maneuver field equipment which will be used to conduct geophysical surveys. There are no critical habitat and known cultural resources to be avoided at Dunn Field..

7.2.2 If any larger specimens (trees) are determined to impact the investigation, Parsons ES will advise CEHNC and DDMT. No further site action will be taken without full coordination and approval of CEHNC and DDMT.

7.2.2 SOIL DISPLACEMENT

During drilling activities, soil will be displaced in small areas (1 foot by 1 foot).

No areas of concern have been identified at Dunn Field.

Borings are to be completed as groundwater monitoring wells.

7.2.3 STREAMBED SEDIMENT DISTURBANCE

Sampling activities will not be performed in streambeds or stream banks.

7.3 KNOWN SENSITIVE ENVIRONMENTAL RESOURCES

There are no known sensitive environmental resources at Dunn Field.

7.3.1 ENDANGERED ANIMAL SPECIES HABITAT

7.3.1 There are no wildlife species of concern known to occur or having potential for occurrence at or near the site. The most prevalent animal species at the site are roaches (Battella germanica), rats (Rattus nomegicus) and mosquitos (Culex) (COE a, 1995).

7.3.2 Fauna observed at Dunn Field include the following: squirrel (Sciurus niger), Red fox (Vulpes vulpes fulva), morning dove (Zenaidura macroura), quail (Colinus virginianus), and box turtles (Terrepene carolina).

7.3.2 ENDANGERED PLANT HABITAT

There are no plant species of concern known to occur or having potential for occurrence at or near the site. Flora at the site include Bermuda grass and black oak (Quercus velutina) (COE a, 1995).

7.3.3 ARCHAEOLOGICAL RESOURCES

There are no cultural resources identified at Dunn Field. Dunn Field is located on land originally used for cotton cultivation (COE a, 1995). Sampling activities will not be conducted in known or suspected archaeological sites.

7.4 POTENTIAL ENVIRONMENTAL RESOURCE IMPACTS

The primary potential environmental resources impacts of the Dunn Field field investigation will result from limited vegetative clearing and monitoring well installation activities. Procedures outlined in this plan will be strictly followed to avoid violation of any federal, state, or local environmental statutes or regulations, or unnecessary disturbance of natural habitats.

7.5 REQUIRED MITIGATION PROCEDURES

Field investigation activities at Dunn Field have been developed to avoid impacts to sensitive resources. For this reason, extensive mitigation is not anticipated. However, the following general mitigation procedures will be followed during all field activities:

1. Impacts to sensitive species will be minimized during the field investigation activities by avoiding known or suspected sensitive wildlife habitats identified previously.
2. Areas that receive brush clearing treatment will be allowed to revegetate naturally after field survey activities are completed.
3. If major mitigation is required, it will be accomplished by CEHNC.

TAB

8

SECTION 8
REFERENCES

CH2MHill, 1997, *Groundwater Characterization Data Report (Final), Defense Distribution Depot Memphis*, prepared for U.S. Army Corps of Engineers, Huntsville Division, August.

Pawlowski, J., Dr. R. Lewis, T. Dobush, and N. Valleau, 1995, "An Integrated Approach for Measuring and Processing Geophysical Data for the Detection of Unexploded Ordnance,." The Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP '95), pp 965-983, Environmental and Engineering Geophysical Society

Parsons Engineering Science (Parsons ES), 1997, Meeting Minutes dated October 9, 1997, Attending Agencies/Companies: Parsons ES, CEHND, DDMT, and CMS International.

U.S. Army, November 1995, *Chemical Agent Identification Sets (CAIS) Information Package*, U.S. Army Program Manager for Chemical Demilitarization, Department of Defense.

U.S Army Corps of Engineers, Huntsville Division (CEHND), 1997, Statement of Work, Chemical Warfare Materiel, Engineering Evaluation/Cost Analysis, Defense Depot Memphis, Tennessee (DDMT).

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1982, *Installation Assessment of Defense Depot Memphis, Memphis, Tennessee, Report No. 191*, Aberdeen Proving Ground, Maryland.

U.S. Army Corp of Engineers (USACE), 1995a, *Ordnance and Explosive Waste, Chemical Warfare Materials Archive Search Report for Memphis Defense Depot, Memphis, Tennessee, Findings.* St. Louis District, January.

USACE, 1995b, *Ordnance and Explosive Waste, Chemical Warfare Materials Archive Search Report for Memphis Defense Depot, Memphis, Tennessee, Conclusions and Recommendations.* St. Louis District, January.

TAB

Appendix A

APPENDIX A
PARSONS ES
SITE SPECIFIC SAFETY AND HEALTH PLAN

327 109

FINAL

SITE-SPECIFIC SAFETY AND HEALTH PLAN (SSHP) FOR SITE CHARACTERIZATION IN SUPPORT OF AN ENGINEERING EVALUATION/COST ANALYSIS AT OPERABLE UNIT 1 DEFENSE DISTRIBUTION DEPOT MEMPHIS, TENNESSEE

Prepared for

U.S. ARMY CORPS OF ENGINEERS
HUNTSVILLE CENTER
Huntsville, Alabama

Contract No. DACA 87-95-D0018
Task Order No. 19

PREPARED BY

PARSONS ENGINEERING SCIENCE, INC.
5390 Triangle Parkway
Suite 100
Norcross, Georgia 30329

August 1998

Reviewed and Approved By:

Walker J. Duncan, P.G. Project Manager:	Walker J. Duncan **(Signature)**	1 Aug 98 **(date)**
Scott Rowden, C.I.H. Project Health and Safety Representative:	Scott E. Rowden **(Signature)**	3 Aug 98 **(date)**

TABLE OF CONTENTS

Page

SITE-SPECIFIC SAFETY AND HEALTH PLAN
DEFENSE DISTRIBUTION DEPOT MEMPHIS MEMPHIS, TENNESSEE

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

LIST OF FIGURES

LIST OF TABLES

SITE-SPECIFIC SAFETY AND HEALTH PLAN DEFENSE DISTRIBUTION DEPOT MEMPHIS MEMPHIS, TENNESSEE

1.0 INTRODUCTION

1.1 PURPOSE

1.1.1 The nature of this field work makes a Site-Specific Safety and Health Plan (SSHP) a principal concern both during project planning and execution. Planning and field personnel must develop a health and safety consciousness, avoiding unnecessary risks.

1.1.2 The purpose of this SSHP is to establish personnel protection standards and mandatory safety practices and procedures for all work conducted for the site characterization to support the risk assessment and Engineering Evaluation/Cost Analysis (EE/CA) for two chemical warfare materiel (CWM) sites. The sites are located on Operable Unit (OU) 1 at the Defense Distribution Depot Memphis (DDMT), Memphis, Tennessee. The plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted at field work sites.

1.1.3 This SSHP provides general guidance for making decisions during field activities. Sections cover field personnel responsibilities and work procedures, physical and chemical risks, emergency procedures, and levels of personal protection. Site-specific information such as a project description and site history, a contingency plan, a list of emergency contacts, and necessary health and safety equipment are also discussed. Appendix B of the work plan contains guidance on ordnance avoidance during geotechnical operations. Attachment A-1 contains an Accident Report Form and Attachment A-2 contains a Plan Acceptance Form. Attachment A-3 contains an Occupational Safety and Health Administration (OSHA) Job Health and Safety Protection Poster. Attachment A-4 contains information on the Chemical Agent Identification Sets (CAIS) suspected to be buried at the site and Attachment A-5 contains Material Safety Data Sheets (MSDS) for the four primary chemicals of concern at the site. Draft versions of the Memoranda of Agreement are presented in Attachment A-6 and a copy of the TEU Maximum Credible Event (MCE) and No Effects Distance is presented as Attachment A-7.

1.2 APPLICABILITY

1.2.1 The plan provisions are mandatory (as a minimum) for all on-site activities undertaken at OU1 by Parsons Engineering Science, Inc. (Parsons ES) and subcontractor personnel. All site activities comply with the provisions of the Corporate Health and Safety (H&S) Policies and Procedures Manual and applicable standards in 29 CFR Parts 1910 and 1926. As site activities change, this plan may need to be modified. Such modifications are submitted as SSHP addenda and are numbered sequentially. All SSHP addenda are reviewed and approved by the Project H&S Manager.

1.2.2 Parsons ES personnel will be involved in potentially hazardous material activities at this site, however the Edgewood Research Development & Engineering Center (ERDEC), provided by DDMT, will be responsible for on-site sample analysis and air monitoring associated with the health and safety aspects related to CWM. Parsons ES personnel will be knowledgeable of the health and safety hazards associated with the reported CWM buried at the site.

1.2.3 Subcontractors must submit SSHPs to the Project H&S Manager addressing hazards associated with their specific project activities. Subcontractor plans must comply with all applicable standards in 29 CFR Parts 1910 and 1926, and be reviewed by Parsons ES prior to commencing specific site tasks.

1.2.4 All Parsons ES and subcontractor personnel must read this plan and submit a signed Plan Acceptance Form prior to the start of the work at this site. The Plan Acceptance Form is shown as Attachment A-2.

1.2.5 All project work will be conducted in accordance with Parsons ES's standard policies for hazard communication. Material safety data sheets for any chemicals brought on site will be located at Parsons ES's field office. Site orientation and training will be provided to all new employees brought on site and this will include an overview of all known hazards associated with the site. A copy of Parsons ES's hazard communication program will be located at the field office.

1.3 SITE DESCRIPTION AND HISTORY

1.3.1 SITE LOCATION

The DDMT is located within the city limits of Memphis, Tennessee in southwest Tennessee (Figure 1.1), approximately 8 miles east of the Mississippi River and 6 miles north of the Tennessee-Mississippi State line (USATHAMA, 1982). The Memphis International Airport is located about one mile southeast of the DDMT. The depot has been closed and is maintained by the Defense Logistics Agency and under the control of the Defense Distribution Region East (DDRE). The depot is currently undergoing Base Realignment and Closure (BRAC) activities (CEHND, 1997).

1.3.2 SITE DESCRIPTION AND HISTORY

1.3.2.1 DDMT consists of approximately 642 acres and is comprised of the main depot, a bulk mineral storage/historic waste disposal area, military housing, and outdoor recreational facilities. The major features of the DDMT are shown in Figure 1.1. The bulk mineral storage area/historic waste disposal area, known as Dunn Field, is located north of the main depot area. Based on information obtained from depot records and interviews with former depot military personnel, ordnance and explosives (OE) and CWM disposal occurred exclusively on Dunn Field (OU1). OU1 is divided into four separate areas (Areas A through D). Historical information indicates that CWM have been buried in trenches and/or pits located in Areas A and B.

1.3.2.2 DDMT was officially activated on January 26, 1942 as the Memphis General Depot. Since that time, the depot mission and functions have been related to the Army Engineer, Chemical, and Quartermaster Services. DDMT provided supply, stock control, storage, and maintenance for all three services (USATHAMA, 1982).

1.3.2.3 The history of OE and CWM disposal on Dunn Field began in July 1946 when twenty-nine mustard-filled German bombs were destroyed and buried. These bombs were part of a rail shipment en route from Mobile, Alabama to Pine Bluff, Arkansas. Records indicate that some of the bombs were leaking and contaminated the rail lines and freight cars that contained the munitions (USATHAMA, 1982). Prior to reaching Pine Bluff, three railcars were identified as containing leaking munitions and these cars were transferred to the Memphis General Depot for proper handling. The railcars were staged in the main depot area for unloading and decontamination. As the bombs were unloaded from the railcars, those found to be leaking were taken to a slurry pit constructed in Dunn Field for draining of the mustard. The pit was reportedly 30 feet long, 7 feet wide, and 12 feet deep (USACE, 1995a) and contained a chloride of lime slurry. The bombs were drained by shooting holes into the nose of the bombs using a rifle and allowing mustard to drain into the slurry pit. Reports indicate the drained bomb casings were then destroyed in a shallow trench using dynamite in case any of the bombs contained a burster charge. A total of twenty-four 500 kilogram (kg) and five 250 kg bombs were destroyed and of these only the small bomb casings contained a burster charge (USACE, 1995a, 1995b). After draining and destruction operations were completed, all mustard contaminated items (wood, clothing, etc.) were placed into the slurry pit and trench and burned. The exact location of the slurry pit and trench for exploding burster charges is not known, however records indicate that the suspected location may be south of the existing parking lot in Area A (USACE, 1995a, 1995b). Another possible location of the slurry pit has been identified as a series of three burial pits reported to contain chlorinated lime (USACE, 1995a, 1995b). The suspected location of these chlorinated lime pits is in the southern portion of Area A. Both suspected locations are shown in Figure 1.2.

1.3.2.3 During the early to mid 1950s, Chemical Agent Identification Sets (CAIS) -- designated as K951/K952-- were disposed and buried in Dunn Field. The CAIS set contained small glass ampoules of mustard, lewisite (a vesicant chemical agent), chloropicrin, and phosgene which were stored in sealed cylindrical metal containers. CAIS stocks found to be leaking or broken during periodic inspection were reportedly buried in Dunn Field (USATHAMA, 1982). The damaged CAIS may have been broken up and neutralized with

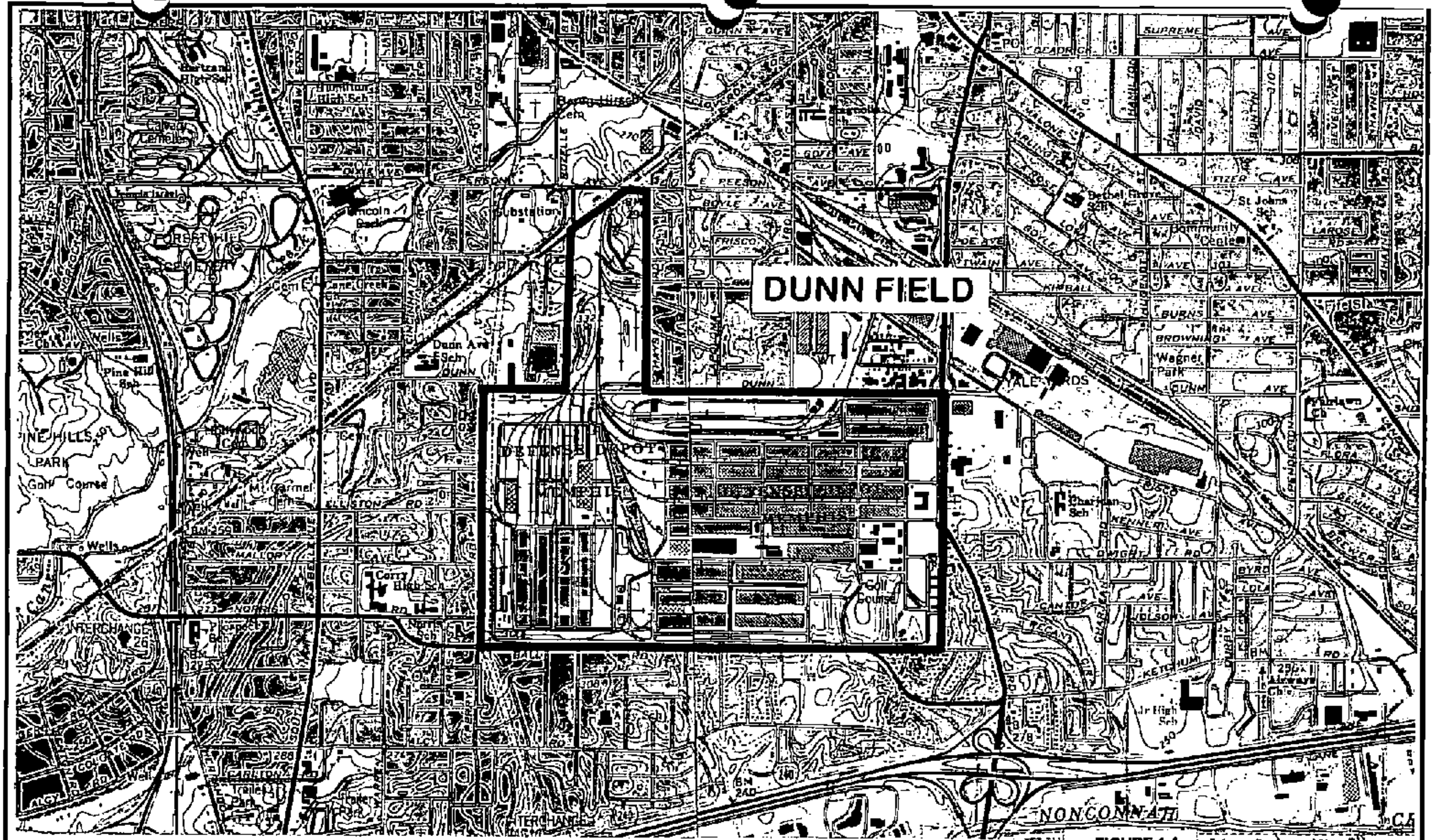
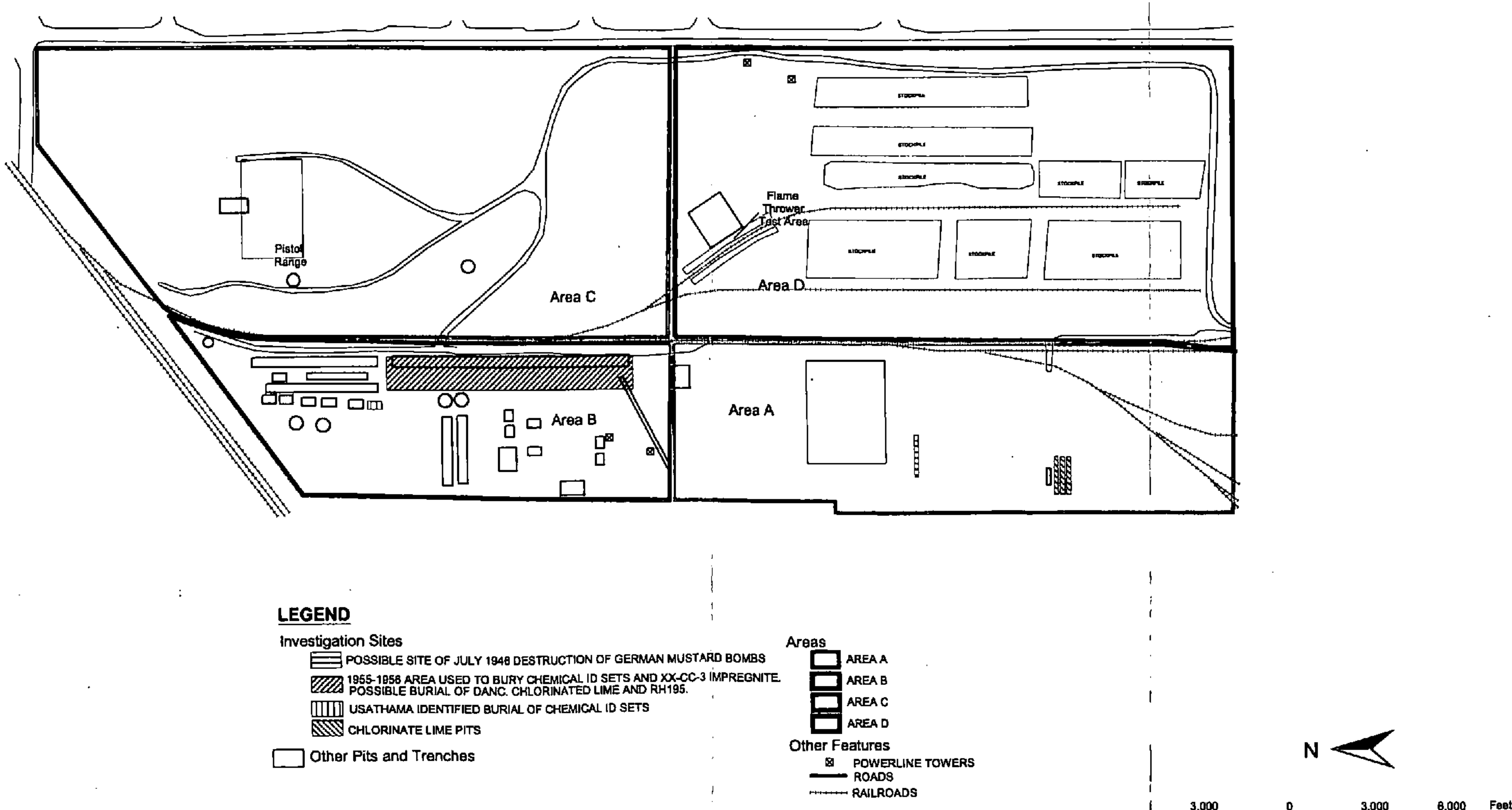


FIGURE 1.1

MAJOR FEATURES **DEFENSE DISTRIBUTION DEPOT** **MEMPHIS, TENNESSEE**	
PARSONS ENGINEERING SCIENCE, INC.	
DATE: OCT. 1997	CREATOR: CHRIS CIRILLO
PATH: J:\GIS\732283\AV	SOURCE: CEHNC

327 118

FIGURE 1.2
Site Map
Defense Distribution Depot
Memphis, Tennessee



PARSONS ENGINEERING SCIENCE, INC.

chlorinated lime, however reports indicate that on at least five or six occasions the sets were put into the pits intact (USACE, 1995a). A description of the K951/K952 CAIS sets is presented in Attachment A-4.

1.3.2.4 The reported disposal areas are located in Area B and possibly Area A. The known locations of CAIS disposal are shown in Figure 1.2. Records indicate that the larger area in Area B also contains outdated or damaged food stocks (USATHAMA, 1982 and USACE, 1995b).

1.3.2.5 The remains of destroyed or partially destroyed OE are also buried in pits on Dunn Field (Area A). Reports indicate that a 3.2 inch mortar round, smoke pots, hand grenades (smoke), and other unspecified OE are buried in these pits (USACE, 1995b).

1.3.2.6 In addition to the chemicals and ordnance described above, other chemicals associated with the use of chemical agents such as Decontaminating Agent Non-Corrosive (DANC) have been buried in Dunn Field. The decontaminant DANC disposed at Dunn Field is an organic N-chloroamide compound in solution with 1,1,2,2-tetrachloroethane. DANC typically contained 90% to 95% 1,1,2,2-tetrachloroethane. Chlorinating compound number 1 (an N-chloroamide) and 1,3-dichloro-5,5-dimethylhydantoin (RH-195) were used as organic chlorinating compounds in DANC.

1.3.2.7 Food stocks, paints, acids, herbicides, and medical waste were also destroyed or buried in pits and trenches in Dunn Field (CEHND, 1997).

1.4 SCOPE OF WORK

1.4.1 Introduction

Parsons ES field activities will include: performance of a geophysical survey; installation of soil borings and monitoring wells; surface soil, subsurface soil and groundwater sampling; and coordination with subcontractors of non-intrusive and intrusive investigations at this site.

1.4.2 Geophysical Investigation

A geophysical investigation will be performed to investigate/characterize two areas within Areas A and B in Dunn Field suspected to have burial pits where chemical agent identification sets (CAIS sets), bomb casings (drained mustard gas bombs) and/or a slurry of mustard gas and chlorinated lime may have been buried. This objective will be achieved by accurately locating and recording the location of geophysical anomalies that represent potential burial pit locations.

1.4.3 Soil Boring and Monitoring Well Installation

Six soil borings will be installed at Dunn Field to characterize the migration of CWM or CWM degradation products from the suspected burial pits into surrounding soil. These borings will be intentionally positioned outside the boundaries of the suspected pits. Each of the borings will be completed as a monitoring well.

1.4.4 Surface/Subsurface Soil and Groundwater Sampling

Surface/subsurface soil and groundwater samples will be collected and analyzed to characterize the nature and extent of releases of CWM or its degradation products from the suspected burial pits to the surrounding soil and groundwater at Dunn Field. Surface and subsurface soil samples will be collected from the monitoring well borings. Groundwater will be sampled from the six newly installed monitoring wells and two existing monitoring wells.

1.5 PROJECT TEAM ORGANIZATION

An overall responsibility chart is presented as Figure 1.3. Table 1.1 describes the responsibilities of all on-site subcontractors and personnel and the names of principal on-site personnel are listed below.

Project Manager: Walker J. Duncan, Parsons ES, Atlanta, Georgia

Site Manager / Site H&S Officer (Geophysical Investigation):

Tamir Klaff, Parsons ES, Atlanta, Georgia

Site Manager / Site H&S Officer (Intrusive Investigation):

Ross Surrency, Parsons ES, Atlanta, Georgia

Project Health and Safety Officer: Scott Rowden, Parsons ES Atlanta, Georgia

Subcontractors:	UXO:	CMS International, Inc., Tampa, Florida
	Drilling:	Atlanta Testing and Engineering, Atlanta, Georgia
	Analytical:	GP Environmental, Gaithersburg, Maryland
	Surveying:	To Be Determined

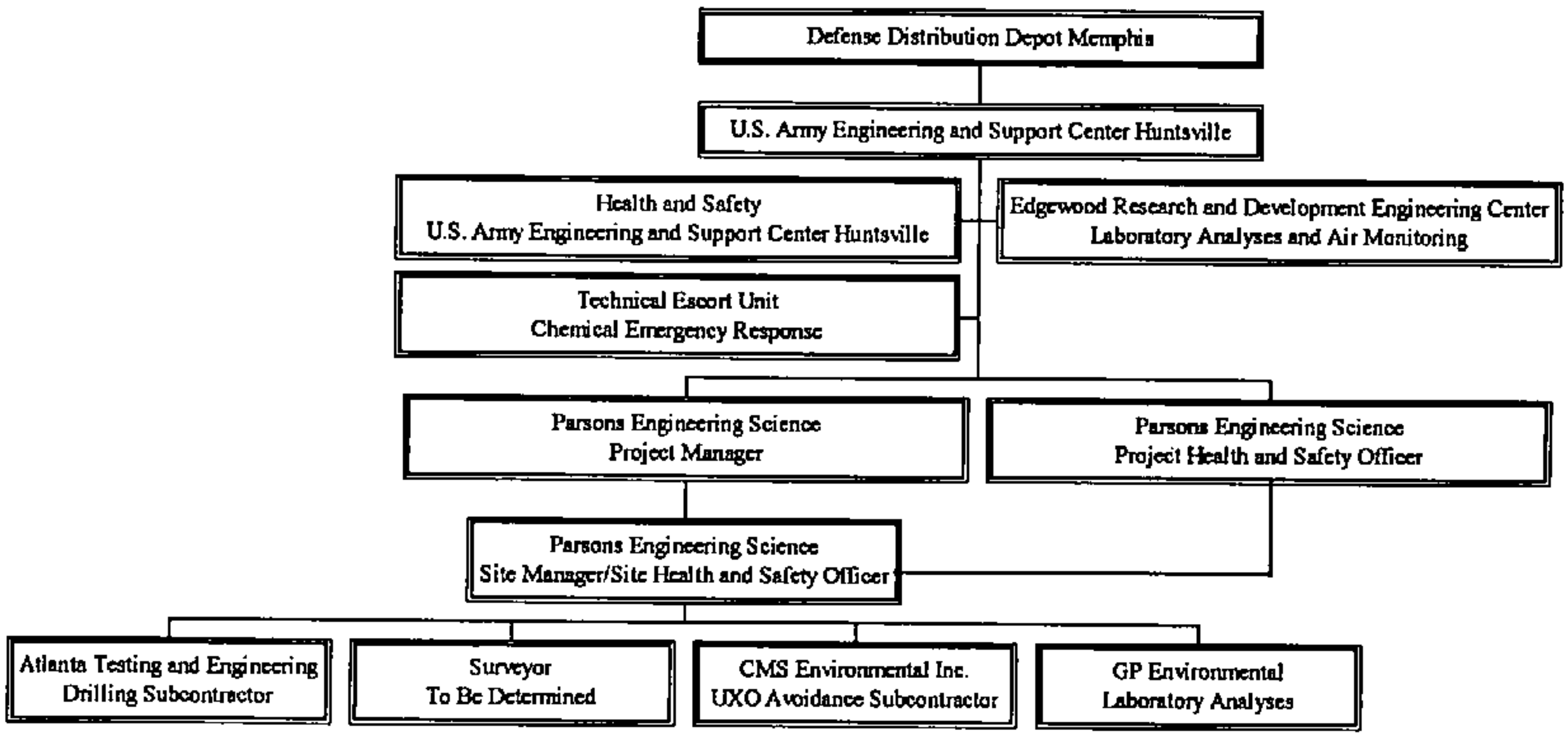
Other Organizations:

Emergency Chemical Response: TEU

Soil and Groundwater Analyses (On-Site): ERDEC

Figure 1.3

Defense Distribution Depot Memphis EE/CA Team



327 121

I:\7232283\plans\hsp\lines.ppt

TABLE 1.1
ON-SITE PERSONNEL

327 122

Title	General Description	Responsibilities
Parsons ES Project Manager	Reports to upper-level management. Has authority to direct response operations. Assumes total control over site activities.	• Prepares and organizes the background review of the situation, the Field Sampling Plan, the Quality Assurance Plan, the SSHP, and the field team. • Obtains permission for site access and coordinates activities with appropriate officials. • Briefs the field teams on their specific assignments. • Uses the site health and safety officer to ensure that safety and health requirements are met. • Serves as the liaison with public officials.
Parsons ES Project Health and Safety Manager	Advises Project Manager on all aspects of H&S	• Provides technical support concerning health and safety issues. • Ensures that the Parsons ES health and safety protocols being followed conform with established industry protocols. • Confirms each team member's suitability for work based on a physician's recommendation. • Conducts field health and safety audits to ensure SSHP conformance and Parsons ES policy compliance. • Certifies that all workers have proper training. • Reports all accidents to Parsons ES Corporate H&S Manager.
Parsons ES Site Health and Safety Officer	Reports to the Project H&S Manager on all aspects of health and safety on site. Performs day-to-day H&S tasks. Stops work if any operation threatens work or public health or safety.	• Ensures that Parsons ES and all subcontractors perform personal inspections of protective equipment and clothing prior to, during, and after each use. • Ensures that Parsons ES's and all subcontractors' protective clothing and equipment are properly stored and maintained. • Controls entry and exit at the access Control Points. • Monitors Parsons ES personnel for signs of stress, such as cold exposure, heat stress, and fatigue. • Implements the SSHP. • Prior to each work event, conducts inspections to determine if the SSHP is being followed.

TABLE 1.1 (Continued)
ON-SITE PERSONNEL

Title	General Description	Responsibilities
Parsons ES Site Health and Safety Officer (cont'd)	Reports to the Project H&S Manager on all aspects of health and safety on site. Performs day-to-day H&S tasks. Stops work if any operation threatens work or public health or safety.	• Knows emergency procedures, evacuation routes, and telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department. • Coordinates decontamination procedures/provisions for medical care with CEHNC/ERDEC personnel. • Notifies CEHNC of emergency conditions. • Ensures that all required equipment is available. • Advises medical personnel of potential exposures and consequences. • Notifies emergency response personnel by telephone or radio in the event of an emergency. • Maintains log book for site workers and visitors. • Acts as spokesperson if OSHA inspector arrives on site. • Conducts on site training concerning pertinent H&S issues and new concerns. • Reports all accidents or H&S incidents to the office H&S Officer and CEHNC.
Parsons ES Site Manager	Responsible for field team operations and safety.	• Manages field operations. • Oversee subcontractors field operations. • Coordinates with the Site Safety and Health Officer in determining protection level. • Enforces site control. • Documents field activities.
Parsons ES Field Team	The work party must consist of at least two people.	• Safely completes the on-site tasks. • Complies with Site Health and Safety Plan. • Notifies Site H&S Officer/Site Manager or Supervisor of suspected unsafe conditions. • Inspects personal protective equipment prior to, during, and after each use.
CMS Environmental	Project UXO/CWM support.	• Conducts surface clearance prior to intrusive activities. • Conducts subsurface geophysical surveys during intrusive activities. • Notifies Site H&S Officer of any suspected subsurface UXO/CWM. • Advises Site H&S Officer on all issues associated with subsurface UXO/CWM.

TABLE 1.1 (Continued)
ON-SITE PERSONNEL

Title	General Description	Responsibilities
TEU	Emergency response/CWM monitoring.	• Provides CWM monitoring during intrusive activities. • Provides emergency response in the event that CWM are encountered at the site. • Assesses/packages CWM if necessary. • Provides D2PC modeling during investigation.
ERDEC	Soil and groundwater analyses.	• Provides on-site analyses of soil and groundwater for CWM and CWM breakdown product constituents.

2.0 SAFETY AND HEALTH HAZARDS ANALYSIS

Both physical and chemical hazards will present a risk to workers at the DDMT. The level of risk is dependent upon the type of work being done. Table 2.1 presents each activity and types of hazards involved as well as the mitigation actions being taken to prevent accident or injury.

2.1 PHYSICAL HAZARDS

2.1.1 Underground Utilities Hazards

Before any drilling or excavation activities, efforts must be made to determine if underground utilities, including sewers, telephone, water, fuel, or electrical lines, will be encountered, and, if so, where such underground utilities are located. DDMT personnel shall be contacted before starting any subsurface activities, and information concerning buried utilities will be obtained. A digging permit will be obtained from DDMT by the Parsons Site Manager prior to commencing any intrusive activities. DDMT will be responsible for the clearance of buried utilities.

2.1.2 Unexploded Ordnance

CMS International of Tampa, Florida will provide technical assistance in dealing with UXO. Guidance for UXO avoidance during site activities is provided in Appendix B of the Work Plan.

2.1.3 Overhead Electrical Lines and Thunderstorms

2.1.3.1 Precautions will be exercised when drilling near any overhead electrical lines. The driller must maintain a safe clearance distance between overhead utility lines and the drill rig mast at all times. The minimum lateral distance between overhead electrical lines of 50 kilovolts (kv) or less and the drill rig is 10 feet. For lines rated over 50 kv, the minimum lateral clearance between the lines and any part of the rig is 10 feet plus 0.4 inch for each kv over 50 kv.

2.1.3.2 Drilling operations must cease during thunderstorms. The SHSO will determine when these conditions exist.

2.1.4 Slip, Trip, and Fall Hazards

2.1.4.1 Work sites may contain slip, trip, and fall hazards for site workers, such as:

- Holes, pits, or ditches;
- Slippery surfaces;

Table 2.1
Hazards Analysis
Defense Distribution Depot Memphis EE/CA
Memphis, Tennessee

Activity	Potential Hazards	Mitigation
Soil Boring, Sampling, and Well Installation	*CHEMICAL*	
	Inhalation and Dermal Contact of Chemical Warfare Agent	Air Monitoring - ERDEC Protective Clothing, Butyl Rubber Gloves and Boots
	Inhalation and Dermal Contact of Industrial Chemicals and VOCs	Air Monitoring - Parsons ES Protective Clothing, Butyl Rubber Gloves and Boots
	PHYSICAL	
	Unexploded Ordnance	Ordnance Avoidance
	Overhead Electrical Cables	Minimum Drilling Distances
	Underground Utilities	Utility Clearance, Dig Permit
	Motor Vehicles, Heavy Equipment	Health & Safety Training
	Slips, Trips, and Falls	Health & Safety Training, First-Aid Kit
	Thunderstorms	Health & Safety Training
	Heat/Cold Stress	Health & Safety Training
	Noise Induced Hearing Loss	Hearing Protection
	Snakes, Ticks, Insects	Health & Safety Training, First-Aid Kit
	Poisonous Plants	Health & Safety Training, First-Aid Kit
	Chemical Spills	Spill Kit On-site

Table 2.1 Continued
Hazards Analysis
Defense Distribution Depot Memphis EE/CA
Memphis, Tennessee

Activity	Potential Hazards	Mitigation
Surveying	*CHEMICAL*	
	Dermal Contact With Contaminated Material	Contamination Avoidance
	PHYSICAL	
	Slips, Trips, and Falls	Health & Safety Training, First-Aid Kit
	Motor Vehicles	Health & Safety Training
	Heat/Cold Stress	Health & Safety Training
Geophysical Surveying	*CHEMICAL*	
	Dermal Contact With Contaminated Material	Contamination Avoidance
	PHYSICAL	
	Slips, Trips, and Falls	Health & Safety Training, First-Aid Kit
	Motor Vehicles	Health & Safety Training
	Heat/Cold Stress	Health & Safety Training

- Steep grades;
- Uneven grades;
- Sharp objects, such as nails, metal shards, and broken glass;
- Weather conditions, such as snow will make surfaces slippery and obscure visibility.

2.1.4.2 Site personnel will be instructed to look for potential safety hazards and immediately inform the SHSO or the Site Manager about any new hazards. If the hazard cannot be immediately removed, action must be taken to warn site workers about the hazard.

2.1.5 Motor Vehicles and Heavy Equipment

Working with large motor vehicles and heavy equipment can be a major hazard. Injuries can result from equipment hitting or running over personnel, or overturning of vehicles. Vehicles and heavy equipment design and operation will be according to 29 CFR Subpart O, 1926.600 through 1926.602. The following precautions will be taken to help prevent injuries and accidents.

- Brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked and maintained in good working order throughout the duration of field activities.
- Large construction motor vehicles will not be backed up unless the vehicle has a reverse signal alarm audible above the surrounding noise level, backup warning lights, or the vehicle is backed up only when an observer signals it is safe to do so.
- Construction and heavy equipment will be provided with necessary safety equipment including seat belts, roll-over protection, emergency shut-off during roll-over, backup warning lights, and audible alarms.
- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicle.
- Field support vehicles will be equipped with a first-aid kit and appropriate fire extinguisher.

2.1.6 Noise-Induced Hearing Loss

2.1.6.1 Planned activities will involve the use of heavy equipment, such as drill rigs and generators. The unprotected exposure of site workers to this noise during activities can result in noise-induced hearing loss. The SHSO will ensure that either earmuffs or disposable foam earplugs are made available to, and used by, all personnel near operating heavy equipment, or other sources of high intensity noise. Hearing protection is required any time the noise level reaches 85 dbA or greater. Double protection is required anytime noise levels exceed 104 dbA. Hazardous Noise Placards will be posted as required.

2.1.6.2 Noise monitoring will be accomplished by field determination - if the whispered voice cannot be heard at a minimum three foot distance - hearing protection will be required.

2.1.7 Heat Stress

2.1.7.1 General

2.1.7.1.1 Sweating does not cool the body unless moisture is removed from the body. The use of personal protective equipment (PPE) reduces the body's ability to eliminate large quantities of heat because the evaporation of sweat is decreased. The body's effort to maintain an acceptable temperature may become impaired and this may cause heat stress. Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks.

2.1.7.1.2 Heat related problems include heat rash, fainting, heat cramps, heat exhaustion, and heat stroke. Heat rash occurs because sweat is not evaporating, making the skin wet most of the time. Standing erect and immobile in the heat allows blood to pool in the lower extremities. As a result, blood does not return to the heart to be pumped back to the brain and fainting may occur. Heat cramps are painful spasms of the muscles due to excessive salt loss from profuse sweating. Heat exhaustion occurs due to the large fluid and salt loss from profuse sweating. A person's skin is clammy and moist; and nausea, dizziness, and headaches may be exhibited.

2.1.7.1.3 Heat stroke occurs when the body's temperature regulatory system has failed. Skin is hot, dry, red, and spotted. The affected person may be mentally confused, delirious, and convulsions may occur. A person exhibiting signs of heat stroke should be removed from the work area to be shaded area immediately. The person should be soaked with water and fanned to promote evaporation. Medical attention should be obtained immediately. EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH.

2.1.7.1.4 Monitoring of personnel wearing PPE should begin when the ambient temperature is 70°F or above. Table 2.2 presents the suggested frequency for such monitoring. Monitoring frequency should increase as the ambient temperature increases or as slow recovery rates are observed. Heat stress monitoring should be performed by a person with a current first-aid certification who is trained to recognize heat stress symptoms. Other methods for determining heat stress monitoring, such as the wet bulb globe temperature (WBGT) index from American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLV) booklet can be used.

Table 2.2[1]
Suggested Frequency of Physiological Monitoring
For Fit and Acclimatized Workers[a]
Operable Unit (OU) 1
Defense Distribution Depot Memphis
Memphis, Tennessee

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°- 30.8°C)	After each 90 minutes work	After each 60 minutes of work
77.5°-82.5°F (25.3°- 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°- 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

(1) NIOSH/OSHA/USCG/EPA, 1985.

(a) For work levels of 250 kilocalories/hour.

(b) Calculate the adjusted air temperature (ta adj) by using the equation:
ta adj = ta + (13 x percent sunshine)
where: ta is the air temperature in °F.

Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat.

Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine = no cloud cover and a sharp, distinct shadow; zero percent sunshine = no shadows.)

(c) A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

2.1.7.2 Early Symptoms of Heat Related Problems

Early symptoms of heat related problems include the following:

1. Decline in task performance
2. Lack of coordination
3. Decline in alertness
4. Unsteady walk
5. Excessive fatigue
6. Muscle cramps
7. Dizziness

To monitor the worker, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.
  - If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
  - If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.
- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
  - If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.
  - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third.
  - Do not permit a worker to wear a semipermeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

2.1.7.3 Prevention of Heat Stress

Proper training and preventive measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illnesses. To avoid heat stress, the following steps should be taken:

- Adjust work schedules.
  - Modify work/rest schedules according to monitoring requirements.
  - Mandate work slowdowns as needed.
  - Perform work during cooler hours of the day, if possible, or at night if adequate lighting can be provided.

- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluids intake must approximately equal the amount of water lost in sweat, i.e. 8 fluid ounces (0.23 liters) of water must be ingested for approximately every 8 ounces (0.23 kg) of weight loss. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
  - Maintain water temperature at 50° to 60°F (10°-16.6°C).
  - Provide small disposable cups that hold about 4 ounces (0.1 liter).
  - Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
  - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat-related illnesses.
- Rotate personnel and alternate job functions.
- Avoid double shifts and/or overtime.

2.1.8 Cold-Related Illness

Exposure to low temperatures presents a risk to employee safety and health both through the direct effect of the low temperature on the body and collateral effects such as slipping on ice, decreased dexterity, and reduced dependability of equipment. Work conducted in the winter months can become a hazard for field personnel due to cold exposure. All personnel must exercise increased care when working in cold environments to prevent accidents that may result from the cold. The symptoms of cold exposure include frostbite and hypothermia. Wind increases the impact of cold on a person's body. Work will cease under unusually hazardous conditions (e.g., windchill less than 20°F, or wind chill less than 30°F with precipitation). Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally labeled frostbite. Recognition of the symptoms of cold-related illness will be discussed during the health and safety briefing conducted prior to the onset of site activities.

- **Hypothermia.** Hypothermia is defined as a decrease in a person's core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interferences with any of these mechanisms can result in hypothermia, even in the absence of "cold" ambient temperatures. The first symptom of systemic hypothermia is shivering. Maximum shivering starts when the core body temperature drops below 95°F. The next set of symptoms as the body's cooling progresses is apathy, listlessness, and sleepiness. The person remains conscious and responsive with normal blood pressure and a core temperature of 93.2°F. The person must be removed immediately to a facility with heat. As hypothermia advances beyond this point, the person has a glassy stare, slow pulse, slow respiratory rate, and may lose consciousness. Severe hypothermia starts when the core body temperature reaches 91.4°F. Finally, the extremities start to freeze hard and death could result.

2.1.9 Snakes

A person bitten by a snake should try to lie still and be quiet. If the bite is in the arm or leg, keep the bite lower than the heart. Staying still and holding the bite lower than the heart will help to slow any poison spreading through the body. Ice the affected area if swelling or color change occur. Get medical care as soon as possible, even if the snake was known to be non-poisonous. The use of snake bite kits is prohibited.

2.1.10 Ticks

If found crawling on a person, ticks should be removed and burned or smashed between two rocks. Do not smash ticks with fingers. If a tick is found to be holding onto the skin, the tick should be covered with Vaseline until it can no longer breathe and backs out of the skin. At that time, all parts of the tick should be removed with tweezers. Areas of the skin where the tick may have crawled, as well as bite area will be scrubbed with soap and water. Hot showers are to be taken as soon as possible after site departure to wash away all ticks that have not adhered to the skin.

2.1.11 Insect Bites/Stings

2.1.11.1 Mild insect bites should be treated by applying a baking soda paste or ice wrapped in a wet cloth. Bee stingers should be gently scraped off the skin, working from the side of the sting.

2.1.11.2 Persons who have been bitten by a brown recluse or black widow spider should be immediately transported to a hospital. The spider should be collected for confirmation of the species. Reactions to a brown recluse spider bite include mild to severe pain within two to eight hours and a star shaped area around the bite within three to four days. Reactions to a black widow spider include intense pain at the site of the bite after approximately 15 to 60 minutes, followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils, and generalized swelling of face and extremities.

2.1.11.3 If insect bites become red or inflamed or symptoms such as nausea, dizziness, shortness of breath, etc., appear, medical care will be sought. Immediate care is needed if a person is allergic to insect bites/stings. Personnel with insect allergies should inform the Project Manager and Site Health and Safety Officer. If an allergic person receives a spider bite or insect bite/sting, seek immediate medical attention, keep the victim calm, and check vital signs frequently. Rescue breathing should be given if necessary to supply oxygen to the victim. Swelling of the breathing passages may require extra hard blowing.

2.1.12 Poisonous Plants

2.1.12.1 The majority of skin reactions following contact with offending plants are allergic in nature and are characterized by:

- General symptoms of headache and fever;
- Itching;
- Redness; and
- A rash.

2.1.12.2 Some of the most common and severe allergic reactions result from contact with plants of the poison ivy group, including poison oak and poison sumac. Such plants produce a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim also may develop a high fever and may be very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

2.1.12.3 The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. In certain seasons, both plants also have greenish-white flowers and berries that grow in clusters.

2.1.12.4 A person experiencing symptoms of poison ivy or poison oak should remove contaminated clothing; wash all exposed areas thoroughly with soap and water. Apply calamine or other poison ivy/oak lotion if the rash is mild. Seek medical advice if a severe reaction occurs, or if there is a known history of previous sensitivity. Oak and ivy cleanser can be used after site work or after potential exposure to reduce chances of irritation.

2.1.13 Chemical Spills

A spill kit will be maintained at the site in case a chemical being used at the site (such as sodium hypochlorite, a decontamination chemical) is spilled. The kit will include spill absorbers (spill socks, pads, and pillows), disposable bags, and a 35 gallon container. Approximately 28 gallons of spilled oil, coolants, solvents, or water can be absorbed using the contents of the kit.

2.1.14 Permitted Confined Space

A permit-required confined space is a confined space that contains a potentially hazardous atmosphere, a material that has the potential to engulf an entrant, a configuration such that an entrant could get trapped, or any other recognized serious safety or health hazard. Permit-confined spaces will not be entered at the site during this project.

2.2 CHEMICAL HAZARDS

Table 2.3 lists contaminants of concern that have been detected or are suspected at Dunn Field. Potential contaminants which are suspected based on reported disposal of Chemical Agent Identification Sets (CAIS) of type K951/K952 are mustard, lewisite, chloropicrin, and phosgene. These compounds are included in Table 2.3 and a description of the K951/K952 sets is presented as Attachment A-4.

Table 2.3 contains a number of volatile organic compounds detected in groundwater at the site. Metals and semi-volatile compounds have also been detected in groundwater at DDMT, however, these non-volatile compounds do not present a health hazard to personnel given the established minimum protective ensemble (Level D) and the activities to be performed. Several herbicides and polynuclear aromatic hydrocarbons have been detected in soils at DDMT.

Table 2.3 lists the potential routes of exposure and the symptoms for each contaminant. Other information such as Threshold Limit Values (TLVs), Permissible Exposure Limits (PELs), Immediately Dangerous to Life or Health (IDLH) values, and applicable properties are also found in this table.

2.2.1 Material Safety Data Sheets (MSDSs)

2.2.1.1 The Hazard Communication Program (29 CFR 1910.1200) has as its stated purpose:

"to ensure that the hazards of all chemicals produced or imported by chemical manufacturers or importers are evaluated and that information concerning their hazards are transmitted to affected employers and employees."

2.2.1.2 Parsons ES is responsible for providing HAZCOM training to their employees. The SHSO will ensure that hazardous chemicals are identified by appropriate warning labels or signs. The PHSO will evaluate the effectiveness of the hazard communication program for site work at DDMT during site audits. Based on these evaluations, it may become necessary to provide additional employee training and/or establish specific operating procedures.

2.2.1.3 MSDSs for mustard, lewisite, chloropicrin, and phosgene are attached to this plan as Attachment A-5. MSDSs will also be provided to workers by Parsons ES for chemicals brought to the site for investigative work. They will be maintained in the field office for immediate access by site workers.

2.3 MEDICAL MONITORING

Personnel engaged in hazardous waste operations are required to be enrolled in a medical monitoring program as required by 19 CFR 1910.120(f). Medical surveillance on this project will also be in accordance with Department of the Army Pamphlet (DA PAM) 40-173. Parsons utilizes the services of licensed, local physicians for medical examinations and a contract occupational health physician to review all medical records to provide medical surveillance of employees at the various Parsons ES offices. Medical monitoring is also required for subcontractors. A letter (signed by a physician) attesting to each individual's fitness for duty must be provided to the Project Manager prior to beginning work.

Table 2.3
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN
Defense Distribution Depot Memphis, Memphis, Tennessee

Compound	PEL [a] (ppm)	TLV [b] (ppm)	IDLH [c] (ppm)	Odor Threshold [d] (ppm)	Ionization Potential [e] (eV)	Physical Description/Health Effects/Symptoms
Carbon Tetrachloride	10	5	200	70	11.47	Colorless liquid with characteristic ether-like odor. Irritates eyes and skin Central nervous system depression, nausea, vomiting. Injury to liver and kidney. drowsiness, dizziness, and incoordination.
Chlorobenzene	75	10	1000	0.2	9.07	Colorless liquid with almond like odor. Irritates eyes, nose, and skin. Drowiness, Incoordination, Central nervous system depression. Liver, lung, and kidney injury in animals.
Chloroform (Trichloromethane)	2	10	500	100 [f]	11.42	Colorless, heavy liquid with pleasant odor. Irritates eyes and skin. Anaesthetic. Causes dizziness, mental dullness, nausea, confusion, headache, fatigue, anesthesia, and enlarged liver. Also attacks kidneys and heart. In animals, causes liver and kidney cancer. Mutagen, experimental teratogen, and carcinogen.
Chloropicrin	0.1	0.1	2	1.1	?	Colorless to faint-yellow, oily liquid with an intensely irritating odor. Chloropicrin causes eye irritation and tearing. It also causes cough, nausea, and vomiting, and severe irritation of the skin. Breathing vapors may also cause delayed severe breathing difficulties which may cause death.
Phosgene	0.1	0.1	2	0.5	11.55	Colorless gas with a suffocating odor like musty hay. Phosgene is a burning agent that is extremely destructive to the tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

327 136

I:\3223\PLAN\HSPLAN\Chemhaz.tbl

Table 2.3
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN
Defense Distribution Depot Memphis, Memphis, Tennessee

Compound	PEL [a] (ppm)	TLV [b] (ppm)	IDLH [c] (ppm)	Odor Threshold [d] (ppm)	Ionization Potential [e] (eV)	Physical Description/Health Effects/Symptoms
Dichlorodiphenyltrichloroethane (DDT)	1 mg/m^3 [f] (skin) [b]	0.5 mg/m^3 [f]	500 mg/m^3 [f]	NA [g]	NA [g]	Colorless crystals or off-white powder with a slight aromatic odor. Irritaes eyes and skin, Paresthesia of toungue, lips and face, tremors, apprhension, dizziness, confusion, vague feeling of discomfort, headache, fatigue, convulsions, vomiting, and carcinogen.
1,1-Dichloroethane (DCA)	100	100	3,000	5	11.06	Colorless, oily liquid with chloroform-like odor and hot saccharine taste. Irritates skin. Causes CNS depression and kidney, lung, and liver damage. Experimental teratogen and questionable carcinogen.
1,2-Dichloroethane (DCA) (Ethylene Dichloride, EDC)	1	10	50	100	11.05	Colorless liquid with a pleasant, chloroform-like odor. Strong narcotic. Irritates eyes. Causes corneal opaqueness, nausea, CNS depression, vomiting, dermatitis, and damage to liver, kidneys, and cardiovascular system. In animals, causes cancer of the forestomach, mammary gland, and circulatory system. Mutagen, experimental teratogen, and carcinogen.
1,1-Dichloroethene (DCE) (Vinylidene Chloride)	1	5	NA [b]	NA [g]	NA [g]	Colorless liquid or gas (>89°F) with a mild, sweet, chloroform-like odor Irritates eyes, skin, and throat. Causes dizziness, headaches, nausea, shortness of breath, liver and kidney dysfunctions, and lung inflammation. Mutagen and carcinogen.
1,2-Dichloroethene (DCE)	200	200	1000	1	9.65	Colorless liquid with a slightly acrid, chloroform like odor. Irritates eyes and respiratory system. Central nervous system depression
Dieldrin	0.25 mg/m^3 [f] (skin) [b]	0.25 mg/m^3 [f] (skin) [b]	50 mg/m^3 [f]	NA [g]	NA [g]	Colorless to light-tan, crystalline, organochlorine insecticide with a mild, chemical odor. Causes headaches, dizziness, nausea, vomiting, vague discomfort, sweating, limb jerking, convulsions, and coma. In animals, causes kidney and liver damage and lung, liver, thyroid, and adrenal gland tumors. Mutagen, experimental teratogen, and carcinogen.

Table 2.3
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN
Defense Distribution Depot Memphis, Memphis, Tennessee

Compound	PEL [a] (ppm)	TLV [b] (ppm)	IDLH [c] (ppm)	Odor Threshold [d] (ppm)	Ionization Potential [e] (eV)	Physical Description/Health Effects/Symptoms
Mustard (H, HD)	0.003 mg/m^3 [f] (ceiling) [i]	NA [g]	NA [g]	NA [g]	NA [g]	Blister agent. Yellow, oily liquid. Garlic odor. Reddening of skin or appearance of blisters may occur several hours after exposure.
Lewisite (L)	0.003 mg/m^3 [f] (ceiling) [i]	NA [g]	NA [g]	NA [g]	NA [g]	Blister agent. Dark oily liquid with geranium-like odor. Immediate pain on contact. Affects eyes, lungs, and blisters skin. Acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure. Experimental teratogen.
Methylene Chloride (Dichloromethane, Methylene Dichloride)	25	50	2,300	200	11.32	Colorless liquid (gas > 104°F) with a sweet, chloroform-like odor (not noticeable at dangerous concentrations). Irritates eyes and skin. Causes nausea, vomiting, fatigue, weakness, unnatural drowsiness, light-headedness, numbness, tingling limbs, and nausea. In animals, causes lung, liver, salivary and mammary gland tumors. Mutagen, experimental teratogen, and carcinogen.
Phosphorus (white or yellow)	0.1 mg/m^3 [f]	0.1 mg/m^3 [f]	5 mg/m^3 [f]	NA [g]	NA [g]	White to yellow, soft, waxy solid with acrid fumes. Usually shipped or stored in water. Ignites spontaneously in moist air. Irritates eyes, skin, and respiratory tract. Causes skin burns, abdominal pain, nausea or vomiting, jaundice, anemia, dental pain, salivation, sweating, blue skin, liver damage, and jaw pain and swelling. Also affects kidneys.
Tetrachloroethene (PCE) (Perchlorethylene)	25 [h]	25	150	5	9.32	Colorless liquid with a mild chloroform odor. Eye, nose, skin and throat irritant. Causes nausea, flushed face and neck, vertigo, dizziness, headaches, hallucinations, incoordination, drowsiness, coma, pulmonary changes, and skin redness. Cumulative liver, kidney, and CNS damage. In animals, causes liver tumors. Mutagen, experimental teratogen, and carcinogen.

Table 2.3
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN
Defense Distribution Depot Memphis, Memphis, Tennessee

Compound	PEL [a/] (ppm)	TLV [b/] (ppm)	IDLH [c/] (ppm)	Odor Threshold [d/] (ppm)	Ionization Potential [e/] (eV)	Physical Description/Health Effects/Symptoms
1,1,2,2-Tetrachloroethane	1 (skin) [b/]	1 (skin) [b/]	100	50	11.10	Heavy, colorless to pale-yellow liquid with pungent, chloroform-like odor. Powerful narcotic and liver poison. Strong irritant to eyes and mucous membranes. Causes nausea, vomiting, abdominal pain, finger tremors, jaundice, hepatitis, liver tenderness, dermatitis, blood disorders, sleepiness, hallucinations, distorted perceptions, tearing, salivation, restlessness, dizziness, convulsions, coma, death, and kidney damage. In animals, causes liver tumors. Mutagen and carcinogen.
1,1,1-Trichloroethane (TCA) (Methyl Chloroform)	350	350	700	20	11.00	Colorless liquid with a mild chloroform-like odor. Irritates eyes and skin. Causes headaches, exhaustion, CNS depression, poor equilibrium, dermatitis, liver damage, cardiac arrhythmia, hallucinations or distorted perceptions, motor activity changes, aggression, diarrhea, and nausea or vomiting. Mutagen, experimental teratogen, and questionable carcinogen.
1,1,2-Trichloroethane (TCA)	10 (skin) [b/]	10 (skin) [b/]	100	NA [f/]	11.00	Colorless liquid with a sweet, chloroform-like odor. Irritates eyes, skin, lungs, and nose. Causes dermatitis, liver and kidney damage, and CNS depression. In animals, causes liver cancer. Mutagen and carcinogen.
Trichloroethene (TCE)	50	50	1,000	20	9.45	Clear, colorless or blue liquid with chloroform-like odor. Irritates skin and eyes. Causes fatigue, giddiness, headaches, vertigo, visual disturbances, tremors, nausea, vomiting, drowsiness, dermatitis, skin tingling, cardiac arrhythmia, and liver injury. In animals, causes liver and kidney cancer. Mutagen, experimental teratogen, and carcinogen.

a/ PEL = Permissible Exposure Limit. OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm. Expressed as parts per million (ppm) unless noted otherwise. Some states (such as California) may have more restrictive PELs. Check state regulations.

b/ TLV = Threshold Limit Value - Time-Weighted Average. Average air concentration (same definition as PEL, above) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). *1997 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

Table 2.3
HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN
Defense Distribution Depot Memphis, Memphis, Tennessee

Compound	PEL a/ (ppm)	TLV b/ (ppm)	IDLH c/ (ppm)	Odor Threshold d/ (ppm)	Ionization Potential e/ (eV)	Physical Description/Health Effects/Symptoms

c/ IDLH = Immediately Dangerous to Life or Health. Air concentration at which an unprotected worker can escape without debilitating injury or health effects. Expressed as ppm unless noted otherwise. IDLH values are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1994.
d/ Values published in *Fundamentals of Industrial Hygiene*, National Safety Council, Appendix C, 1979.
e/ Ionization Potential, measured in electron volts (eV), used to determine if field air monitoring equipment can detect substance. Values are published in the *NIOSH Pocket Guide to Chemical Hazards*, June 1994.
f/ mg/m^3 = milligrams per cubic meter.
g/ NA = Not available.
h/ (skin) = Refers to the potential contribution to the overall exposure by the cutaneous route.
i/ Olfactory fatigue has been reported for the compound and odor may not serve as an adequate warning property.
j/ (ceiling) = Ceiling concentration which should not be exceeded at any time.
k/ NIOSH recommends reducing exposure to the lowest feasible concentration, and limiting the number of workers exposed.

3.0 PERSONNEL PROTECTION AND MONITORING

3.1 PERSONAL PROTECTIVE EQUIPMENT

3.1.1 Parsons ES staff will work onsite during survey, brush clearing, geophysical survey, soil boring and monitoring well installation, and groundwater sampling work. ***If at any point in the investigation CWM is detected, work is to stop immediately and actions outlined in Section 5.0 will be taken immediately.*** Personnel will wear Level D protection in established work zones on DDMT:

- Standard work clothes with long pants and sleeves;
- Safety boots (except during geophysical work);
- Hard hat when overhead hazards exist; and
- Hearing protection when near heavy equipment.

3.1.2 Personnel working away from established work zone areas will not be required to wear safety boots, long sleeves, or hard hats.

3.1.3 During intrusive activities and soil/groundwater sampling, personnel will be required to wear modified Level D protection consisting of the following:

- Positive-pressure (slung) escape packs (supplied air) for chemical warfare agent releases (i.e. lewisite and mustard);
- Chemical-resistant clothing with hood (e.g. Saranex®, PVC-coated Tyvek®);
- Splash goggles or safety glasses with side shields (when splash or flying particle hazards exist);
- Inner PVC gloves;
- Outer butyl-rubber gloves;
- Chemical-resistant butyl-rubber boots;
- Hard hat when overhead hazards exist; and
- Hearing protection when near heavy equipment.

3.1.4 Level B and C protection may be required in the event that elevated PID/OVA or phosgene/chloropicrin readings are encountered. ***If at any point in the investigation CWM is detected, work is to stop immediately and actions outlined in Section 5.0 will be taken immediately.*** For non-CWM constituents, the Level B and C protective ensembles used will consist of the following:

Level B

- Supplied-air full-face respirator, either SCBA or air line, positive-pressure, with 5-minute escape bottle;
- Chemical-resistant clothing with hood (e.g. Saranex®);
- Inner polyvinylchloride (PVC) gloves;
- Outer butyl-rubber gloves;
- Chemical-resistant butyl-rubber safety boots;
- Hard hat; and
- Hearing protection when near heavy equipment.

Level C

- Air-purifying, full-face respirator with organic vapor/high efficiency particulate air (HEPA) cartridges (NIOSH and MSHA approved), depending upon potential exposure risk;
- Chemical-resistant clothing with hood (e.g. Saranex®, PVC-coated Tyvek®);
- Inner PVC gloves;
- Outer butyl-rubber gloves;
- Chemical-resistant butyl-rubber safety boots;
- Hard hat; and
- Hearing protection when near heavy equipment.

3.2 MONITORING REQUIREMENTS

3.2.1 Work areas will be continually monitored to identify any changes in existing conditions. Direct observation will be used to identify unusual conditions such as visible vapors and discolored liquids and solids (e.g., colored groundwater). In addition, air monitoring instruments will be used to identify and quantify airborne levels of chemical agents, organic vapor, and combustible gases. Air monitoring will be conducted using the following equipment:

- Photoionization detector (PID) with an 11.7 electron volt (eV) lamp or organic vapor analyzer (OVA) to monitor for VOCs (calibrated, operated, and maintained by Parsons ES);
- Combustible gas indicator to measure the concentration of combustible gases or vapors such as methane (calibrated, operated, and maintained by Parsons ES);
- MINICAM to detect the presence of mustard and lewisite (calibrated, operated, and maintained by ERDEC); and

- Detection tubes to detect the presence of phosgene and chloropicrin (used by Parsons ES).

3.2.2 Air monitoring using the PID/OVA® will be accomplished at the following times:

- When a different type of field activity begins;
- When intrusive work begins on a different portion of the site;
- After each 2-foot drilling interval (down to 15 ft);
- After each 2-foot drilling interval; and
- Once each hour during drilling activities.

3.2.3 Air monitoring using detector tubes (for phosgene and chloropicrin) will be accomplished at the following times:

- When a different type of field activity begins;
- When intrusive work begins on a different portion of the site;
- After each 2-foot drilling interval (down to 15 ft);
- Once each hour during drilling activities;
- If any airborne contaminants are detected using the PID/OVA®; and
- If suspect odors are noticed during drilling.

3.2.4 Both the PID and the combustible gas indicator will be calibrated daily, or as required, according to their operating manuals (Appendix E).

3.2.5 The MINICAMS will be calibrated according to U.S. Army Technical Instructions prior to each site activity and will be operated only by qualified ERDEC personnel.

3.3 ACTION LEVELS

The following action levels will be used to determine the required level of protection for work activities. These measurements will be determined using the monitoring instruments described earlier in this section. ***If at any point in the investigation CWM is detected, work is to stop immediately and actions outlined in Section 5.0 will be taken immediately.*** The volatile organic compound (VOC), combustible gas, and phosgene/chloropicrin action levels are outlined in the subsections below.

3.3.1 The following action levels will be used to minimize exposure to VOCs:

Concentration of VOCs in the Breathing Zone*	Required Level of Protection
0 - 1 ppm	Level D
>1 - 25 ppm	Level C
>25 - 1,000 ppm	Level B
> 1,000 ppm	Stop work; reevaluate activities at site area

3.3.2 The following action levels will be used to minimize the potential for fires or explosions due to combustible gases:

Concentration of Combustibles in the Breathing Zone	Required Action
0 - 10% LEL	Continue normal work activities
Above 10%	Stop work; reevaluate activities and site area

3.3.3 Phosgene and chloropicrin (in air) will be monitored using GASTEC (distributed by Sensidyne®) detector tubes No. 16 (for phosgene) and No. 134 (for chloropicrin). The OSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit Value (TLV®) for both of these chemicals is 0.1 parts per million (ppm). The following action levels will be used to indicate a need to change PPE and/or cease or modify operations:

Chemical	Action Level	Basis for Action Level
Phosgene	0.05 ppm	One-half the OSHA PEL and detection limit for tube.
Chloropicrin	0.2 ppm	Lowest available detection limit (i.e., for detector tube).

3.4 SITE-SPECIFIC TRAINING

Site-specific training will include a kickoff training prior to intrusive investigation activities at this site to cover all aspects of this HSP, a pre-operational survey to be conducted by CEHNC and daily "tailgate" training prior to beginning work each day.

3.4.1 Kickoff Training

The Project Safety Officer is responsible for developing a site-specific occupational hazard training program. This program will comply with the CEHNC approved Health and Safety Plan (HSP) for the DDMT site. The Project Safety Officer is responsible for providing training to all Parsons ES personnel and Parsons ES subcontractors working at OU1 when the intrusive investigation activities are being performed. This training will cover the following topics:

- Names of personnel responsible for site safety and health.
- Safe work practices.
- Site history.
- Safety, health, and other hazards at site.
- Work zones and other locations.
- Emergency procedures, evacuation routes, emergency phone numbers.
- Proper use (e.g., donning and doffing) of personal protective equipment.
- Safe use of engineering controls and equipment on the site.
- Acute effects of compounds at the site.
- Ordnance recognition and reporting.
- Prohibitions in areas and zones, including:
  - Site layout, and
  - Procedures for entry and exit of work areas and zones.

3.4.2 Pre-Operational Survey

A pre-operational survey will be required prior to commencing intrusive activities at the site. This survey will be conducted by CEHNC. The survey is conducted to demonstrate on-site worker proficiency prior to performing hazardous operations. Specifically, the pre-operational survey will evaluate and train on-site personnel on:

- Monitoring and recognition of CWM releases;
- Responses to accidental agent releases;
- Medical emergencies associated with chemical agent exposures; and
- Involving local medical and emergency support organizations.

3.4.3 "Tailgate" Training

The Site Safety Officer is responsible for providing daily "tailgate" training to all Parsons ES personnel and Parsons ES subcontractors under Parsons ES H&S supervision that are to work at OU1. The Site Safety Officer is also responsible for providing Kickoff Training for Parsons ES and subcontractor personnel who are on-site when non-intrusive tasks are being performed. This training will cover the following topics:

- Tasks to be performed;

- Time constraints (e.g., rest breaks);
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, or danger signals;
- Emergency procedures; and
- Radio communication (when applicable).

3.4.4 Medical Support Training

Medical support will be provided by an ambulance service, the Regional Medical Center at Memphis, and the University of Tennessee Medical Group, Inc. who have will receive special training in accordance with Memoranda of Agreement (MOAs) with CEHNC. Draft versions of the MOAs are presented in Attachment A-6.

4.0 SITE WORK ZONES AND PERSONNEL DECONTAMINATION

4.1 INTRODUCTION

The following site control measures will be followed to mitigate potential contamination of workers and control access to the worksite. Site control involves the physical arrangement and entry control of the work zones.

4.2 SITE WORK ZONES

Zones will be delineated at the site to segregate different types of operations. To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, the flow of personnel and equipment between the zones shall be controlled. The establishment of the work zones will help ensure that personnel are properly protected against the hazards present where they are working; work activities and contamination are confined to the appropriate areas; and personnel can be located and evacuated in an emergency. Location of site-specific work zones cannot be defined at this time. The following types of zones will be established for soil boring and monitoring well drilling (i.e., intrusive) activities.

4.2.1 Exclusion Zone (Contamination Zone)

The Exclusion Zone (EZ) will include work areas where intrusive investigation takes place. Within the EZ, prescribed levels of PPE will be worn by all personnel. An exclusion zone will be established for drilling activities to prevent personnel from entering these areas without proper safety equipment (e.g., hard hat, steel-toe boots, respirators). The hotline, or EZ boundary, will be established through visual observations and/or general air monitoring requirements. This boundary will be physically marked or well defined by physical and geographic boundaries. All Parsons personnel and subcontractors will be properly trained in controlling and minimizing access to the EZ. Should an unauthorized person enter the EZ they will be stopped and escorted to the support zone. If necessary, work will be stopped until the situation is resolved. Unauthorized entry will be recorded in the field notebook.

4.2.2 Contamination-Reduction Zone (CRZ)

This zone provides an area to prevent or reduce the transfer of hazardous materials which may have been picked up by personnel or equipment leaving the EZ. The organization of the CRZ and control of decontamination operations are described in Section 4.3 of this plan.

4.2.3 Support Zone

The support zone is considered a clean area. The support zone for this project will be located upwind of the work site determined by a streamer or flag attached to the drill rig mast or vehicle antenna to denote the wind direction. The support zone will be located at a distance far enough away from the intrusive activity that during a maximum credible event (MCE), all personnel in this area will be in a safe location. A MCE is the worst possible theoretical event of chemical agent release that could occur as a result of site activities being performed for this project.

The maximum credible event (MCE) for the site was calculated by the TEU Safety Office for 7.1 fluid ounces of mustard (HD) using the D2PC Model. The results of the model indicated the following:

- Zero meters to a 1% lethality distance,
- Zero meters to no deaths distance, and
- Zero to 14 meters as a no effects distance.

The evacuation distance during sampling operations is therefore 15 meters as long as the following operational controls are in place:

- Temperature is between 50 and 80 degrees Fahrenheit during sampling operations.
- Real time monitoring during the sampling activity is continuous and affirmation tests of positive indications are performed in an expeditious manner.
- A plan for safing the hole during soil sampling operations is followed if air monitoring detects the presence of CWM. (Safing the hole entails temporarily sealing the hole and establishing continuous downwind air monitoring.)

A written copy of the TEU MCE and no effects determination (including assumptions used for their calculation is presented as Attachment A-7.) TEU is responsible for providing continuous air monitoring and D2PC modeling for all intrusive activities.

The support zone contains the support vehicles equipped with first-aid kits, fire extinguishers, decontamination materials, and other support supplies. Level D PPE is appropriate apparel within this zone. Contaminated clothing and equipment are not permitted in the support zone. Since activities may be conducted during the winter months, special types of PPE and other safety equipment susceptible to freezing (e.g., eye wash and decontamination solutions) will be stored in a heated space.

4.3 PERSONNEL DECONTAMINATION

4.3.1 Introduction

This section discusses personnel decontamination. Equipment decontamination is discussed in Section 4 of the work plan. To prevent harmful materials from being transferred into clean areas or from exposing unprotected workers, all field personnel exiting an area of potential contamination will undergo decontamination (see Figure 4.1). The extent of decontamination depends on a number of factors, the most important being the type and concentration of the contaminant involved. The following sections describe Levels D, C and B decontamination, as well as decontamination procedures to be followed during medical emergencies.

During MINICAM monitoring of the drill site, if a positive reading is detected, all personnel in the hot zone will put on protective masks and proceed to the personnel decontamination station as shown in Figure 4.2.

FIGURE 4.1

DECONTAMINATION STATION LAYOUT
LEVEL D AND LEVEL D MODIFIED PPE

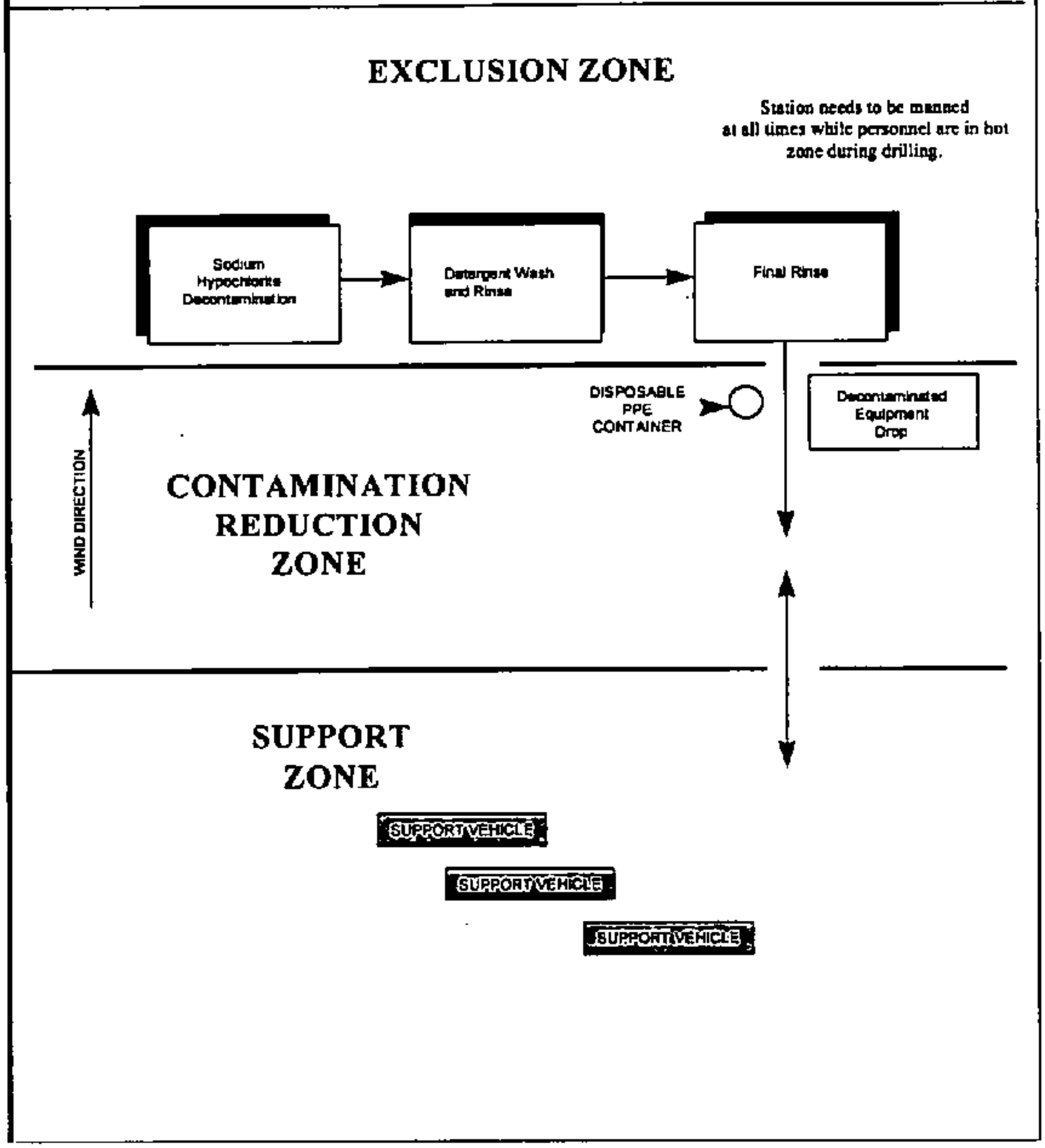
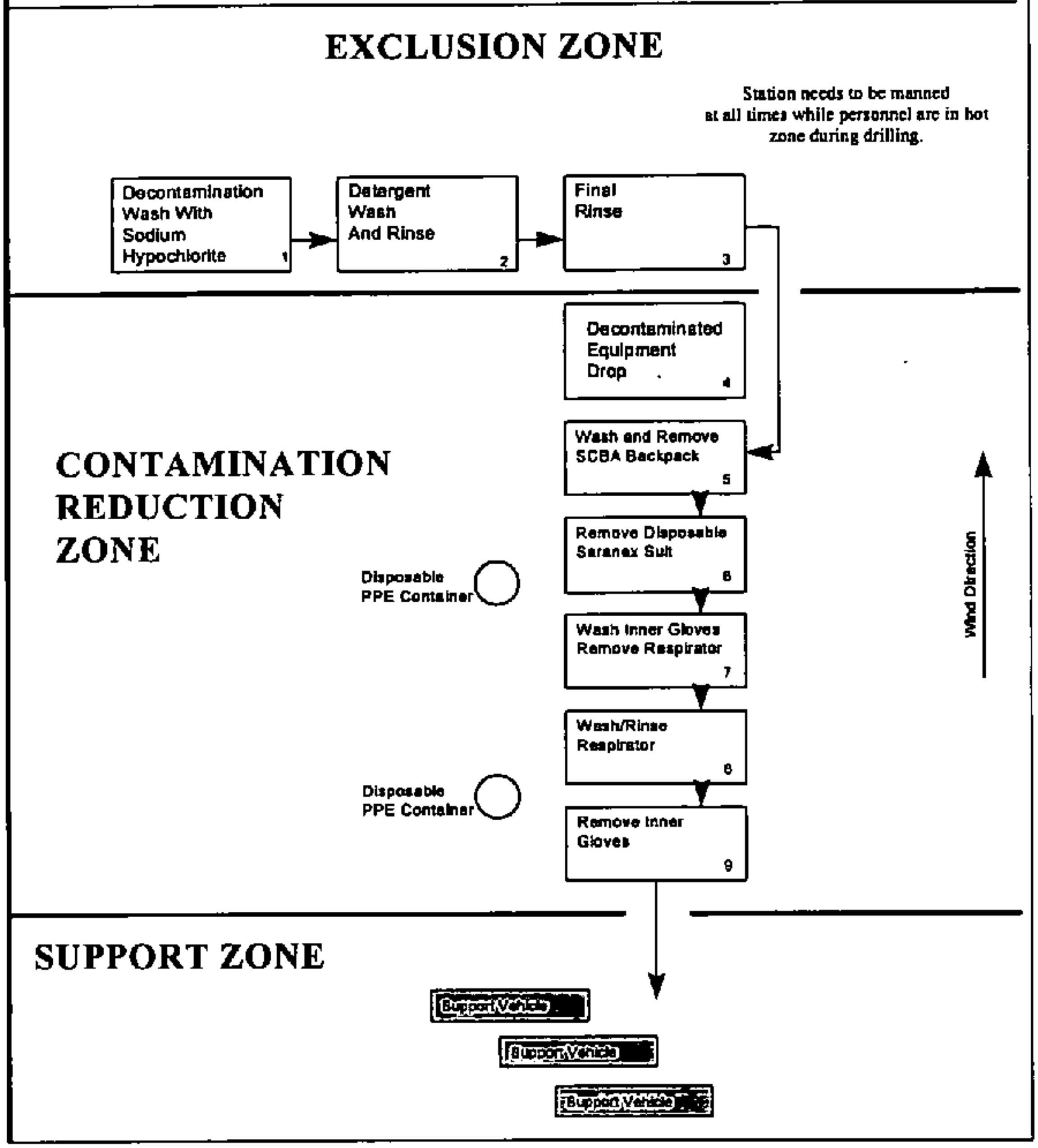


FIGURE 4.2

DECONTAMINATION STATION LAYOUT
LEVEL B AND C PPE



\\PARESATL01\PROJECT\732283\PLANS\H&SPLAN\APP-D4.WW6

4.3.1 Modified Level D Decontamination

Soft-bristled scrub brushes and long-handled brushes will be used to remove contaminants from personnel. Buckets of water or garden sprayers will be used for rinsing. Large plastic garbage bags will be used to store decontaminated clothing (gloves, Saranex® coveralls etc.) and equipment. Metal or plastic cans or drums will be used to store contaminated liquids. Washing and rinsing are done in combination with a sequential doffing of clothing starting at the first decon station with the most heavily contaminated article and progressing to the last station with the least contaminated article.

4.3.2 Modified Level D, Level C and Level B Decontamination Procedures

Decontamination procedures will be divided into nine-stations. Level B, Level C, and modified Level D decontamination will consist of the following (Figure 4.2):

Station 1: Segregated Equipment Drop

Equipment used on the site (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) will be placed on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination.

Necessary equipment includes:

- Containers of various sizes;
- Plastic liners; and
- Plastic drop cloths.

Station 2: Suit/Safety Boot and Outer-Glove Wash

Thoroughly wash chemical-resistant suit, safety boots, and outer gloves. Scrub with long-handled, soft-bristle scrub brush and copious amounts of Liquinox/water/bleach solution. Repeat as many times as necessary.

Necessary equipment includes:

- Container (30 gallon);
- Sodium hypochlorite solution (5.25%);
- Liquinox®/water solution;
- Rinse for Liquinox® wash; and
- Long handle, soft-bristle scrub brushes.

Station 3: Suit/Safety Boot and Outer-Glove Rinse

Rinse off using copious amounts of water. Repeat as many times as necessary.

Necessary equipment includes:

- Container (30 gal);
- Spray unit;
- Water; and
- Long handled, soft-bristle scrub brushes.

Station 4: Outer Gloves and Outer Boot Removal

Remove the outer gloves and boots and deposit in individually marked plastic bags.

Necessary equipment includes:

- Plastic bag; and
- Bench or stool.

Station 5: Cartridge, Respirator, or Tank Change

If a worker leaves the exclusion zone to change cartridges, a respirator, or air tank, this is the last step in the decontamination process. The worker's cartridges are exchanged, new outer glove and boots donned, and joints taped. Worker returns to duty. Otherwise the worker proceeds to Station 6.

Necessary equipment includes:

- Cartridges or air tanks;
- Tape;
- Boot covers; and
- Gloves.

Station 6: Removal of Chemical-Resistant Suit

With assistance of helper, remove suit. Deposit in container with plastic liner.

Necessary equipment includes:

- Container (30 gallon);
- Chair; and

- Plastic liner.

Station 7: Inner-Glove Wash and Rinse

Wash and rinse inner gloves with water. Use a Liquinox®/water solution. Repeat as many times as necessary.

Necessary equipment includes:

- Liquinox®/water solution;
- Water;
- Container; and
- Long handled, soft-bristle brushes.

Station 8: Respirator Removal

Remove facepiece. Avoid touching face. Wash respirator in clean, sanitized solution, allow to dry and deposit facepiece in plastic bag. Store in clean area.

Necessary equipment includes:

- Plastic bags;
- Sanitizing solution; and
- Cotton wipes.

Station 9: Inner-Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Necessary equipment includes:

- Container; and
- Plastic liners.

Modifications can be made to Station 9 decontamination procedures depending upon the extent of contamination. The effectiveness of the decontamination process should be checked by visual inspection and through the use of a photoionization detector.

4.3.3 Personal Protection of Personnel Conducting Decontamination Procedures

Decontamination personnel are required to wear the following protective ensemble:

- Saranex® coveralls (Level C and Level B decontamination);

- PVC or Silver Shield® gloves;
- Chemical-resistant boots (Level C and Level B decontamination); and
- Chemical safety goggles or glasses.

4.3.4 Decontamination Procedures During Medical Emergencies

During some medical emergencies, it may be possible that decontamination would aggravate or cause more serious health effects. If prompt, life-saving, first-aid and medical treatment are required, decontamination procedures may be performed during or after medical transport.

4.3.4.1 Physical Injury

- Physical injuries can range from a sprained ankle to a compound fracture, from a minor cut to massive bleeding. Depending on the seriousness of the injury, treatment may be given at the site by trained personnel. For minor medical problems or injuries, the normal decontamination procedure should be followed.
- For more serious injuries, additional assistance may be required at the site or the victim may have to be transported to a medical facility. Life-saving care should be started immediately, without considering decontamination. The outside garments need not be removed unless they cause delays, interfere with treatment, or aggravate the problem. Respirators and backpack assemblies must always be removed. Chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual should be wrapped in plastic, rubber, or blankets to help prevent contaminating medical personnel and, the inside of ambulances. Outside garments can be removed and decontamination performed at the medical facility.

4.3.4.2 Heat Stress (See Section 2.1.7 for additional information)

- Heat-related illnesses range from mild heat fatigue to life-threatening heat stroke. Heat stroke requires prompt treatment to prevent irreversible damage or death. Less serious stages of heat stress also require prompt attention because they can progress to heat stroke. Unless the victim is obviously contaminated, decontamination should be omitted or minimized and treatment begun immediately. Protective clothing can/should be cut off.

4.3.4.3 Hypothermia, Frostbite (See Section 2.1.8 for additional information)

- Cold-related illnesses range from mild to severe forms of hypothermia and frostbite. Both illnesses should be easily detected at mild stages of development. Decontamination procedures should be conducted as normal. However, staff should work as quickly as possible in order to begin proper treatment.

4.3.4.4 Chemical Exposure

- Exposure to chemicals can be divided into two categories:

1. Injuries from direct contact, such as acid burns or inhalation of toxic chemicals.

2. Potential injury caused by gross contamination of clothing or equipment.

- For inhaled contaminants, treatment can only be performed by qualified physicians. If the contaminant is on the skin or in the eyes, first-aid treatment generally includes flooding the affected area with water. For a few chemicals, however, water may cause more severe problems.

- When protective clothing is grossly contaminated, contaminants may be transferred from the wearer to treatment personnel and cause injuries. Unless severe medical problems have occurred simultaneously with splashes, the protective clothing should be washed off as rapidly as possible and then carefully removed.

5.0 ACCIDENT PREVENTION AND CONTINGENCY PLAN

5.1 ACCIDENT PREVENTION

5.1.1 All field personnel receive site-specific health and safety training before starting any site activities (see Section 3.4). On a day-to-day basis, individual personnel should watch for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Emergencies can be averted by rapid recognition of dangerous situations. Before assigning daily tasks, tailgate safety meetings will be held (see Section 3.4.3).

5.1.2 Hard hats and safety boots must be worn as a minimum within 50 feet of heavy equipment. The Site Manager or Site Health and Safety Officer supervises the field team to ensure they are meeting health and safety requirements. If deficiencies are noted, work is stopped and corrective action is taken (e.g., obtain, purchase additional safety equipment). Reports of health and safety deficiencies and the corrective action taken are forwarded to the Project Manager and Project H&S Manager.

5.1.3 Work will only be performed during the hours of 0700 and 1800 because the Regional Medical Center will only have medical personnel trained to deal with chemical warfare casualties during this period of time. No work will be performed on Sundays.

5.2 CONTINGENCY PLAN

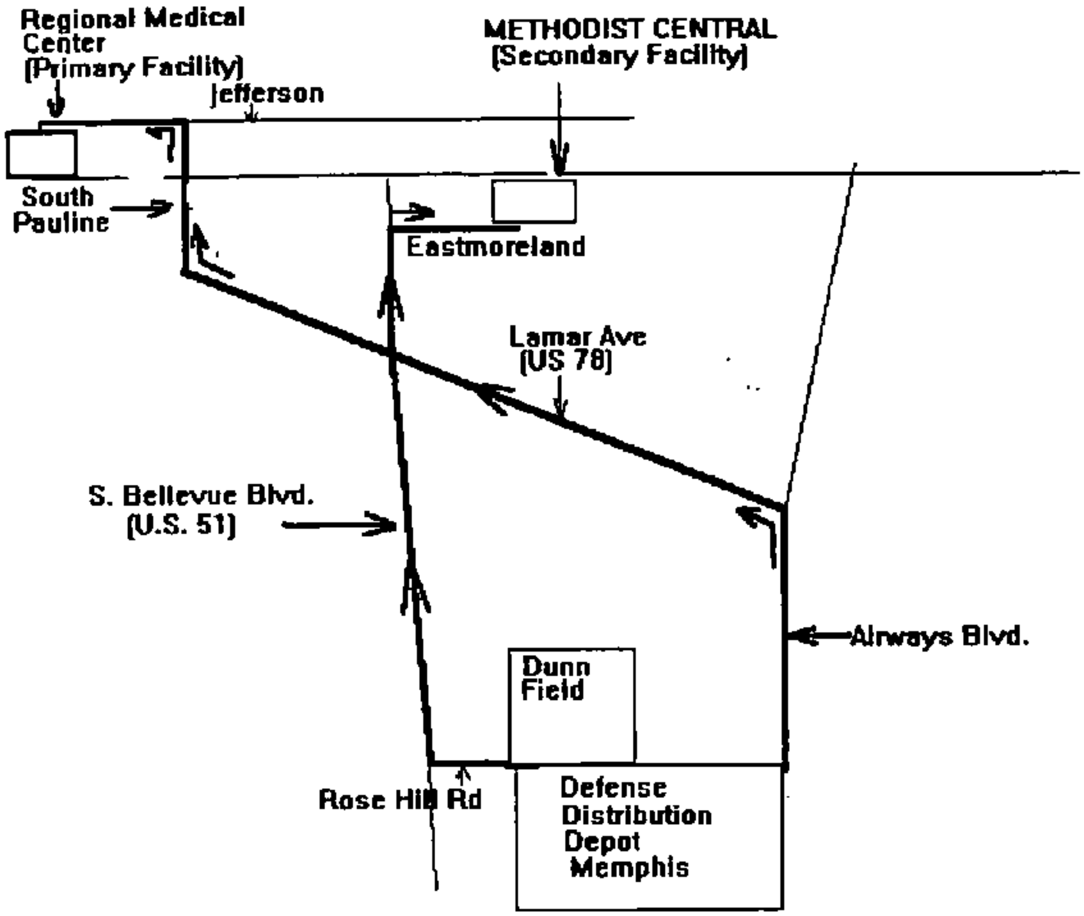
5.2.1 Introduction

5.2.1.1 If an emergency develops on site, the procedures delineated herein are immediately followed. Emergency conditions exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of chemical exposure;
- A condition occurs that is more hazardous than anticipated; and/or
- Fires, explosions, structural collapses/failures, and/or unusual weather conditions (thunderstorms, lightning, high winds, etc.) occur.

5.2.1.2 If an emergency occurs, direct voice communication is used to sound the alarm. If personnel are out of range of direct voice communication, an air horn meeting the requirements of 29 CFR 1910.165 is sounded. The emergency signal is a continuous 15-second blast on a hand-held air horn. Horns will be located with the Site Health and Safety Officer and at the outer perimeter of the contamination reduction zone. In the event of an emergency and the air horn sounds, all personnel will assemble in the support zone, be accounted for, and be given directions on how to proceed. If personnel are working in the exclusion zone, they will exit through the most practical exit. If the emergency warrants rapid egress from the exclusion zone, decontamination will be accomplished in the most practical way possible. General emergency procedures and specific procedures for personal injury are described within this section. Table 5.1 is a list of emergency contacts. Figure 5.1 shows the routes to the primary and secondary medical facilities for this project. The primary facility should be used for all

FIGURE 5.1 ROUTES TO HOSPITALS



trauma emergencies while the secondary facility may be used for non life-threatening emergencies if necessary. An on-site ambulance with paramedics will transport all trauma emergency cases to the Regional Medical Center where medical personnel have been specially trained in chemical warfare casualty treatment.

5.2.2 Emergency Equipment

5.2.2.1 In each operative decontamination area, the Site Health and Safety Officer will establish an emergency equipment station containing the following: an eyewash station, first-aid kit, 20 pound class A, B, and C (ABC) fire extinguisher, and a portable cellular telephone. Copies of pertinent figures including emergency phone numbers and maps to emergency facilities will be displayed at this station. The eyewash units will be located near the source of potential hazards. Each station will be prominently marked.

5.2.2.2 For activities not requiring a decontamination area such as those at which Level D protection is used, a first-aid kit, fire extinguisher, and telephone will be provided. Copies of pertinent figures as discussed above will also be displayed at this station.

5.2.2.3 A DOT approved ambulance accompanied by a paramedic crew who have been trained in chemical warfare agent casualty care and who are 40-hour HAZWOPER certified will be on-site during all intrusive activities to treat any medical emergency. Personnel must be decontaminated if possible prior to being transported to the Regional Medical Center. The paramedic crew will also assist in heat stress monitoring during the project.

5.2.3 General Emergency Procedures

General emergency procedures are as follows:

- Notify the contact listed in Table 5.1 of the SSHP when an emergency occurs. This list is posted prominently at the site.
- Use the "buddy" system (pairs).
- Maintain visual contact between "pairs." Each team member remains close to the other to assist in case of emergencies.
- If any member of the field crew experiences any adverse effects or symptoms of exposure, the entire field crew will immediately halt work and act according to the instructions provided by the Site Manager.
- Any condition that suggests a situation more hazardous than anticipated will result in evacuating the field team and reevaluating the hazard and the level of protection required.
- If an accident occurs, the Site Manager is to complete an Accident Report Form (Attachment A-1). Follow-up action will be taken to correct the situation that caused the accident.
- Radio communication (where applicable).

5.2.4 Personal Injury

In case of personal injury at the site, follow the procedures listed below:

- Field team members or on-site emergency medics trained in first-aid can administer treatment to an injured worker.
- The victim will be transported to the designated medical facility. If necessary, an ambulance may be used to transport the victim.
- The Site Manager is responsible for the completion of an Accident Report Form.

5.2.5 Procedures Implemented for a Major Fire, Explosion, or On-Site Health Emergency Crisis

For such emergencies, the Site H&S Officer/Site Manager shall:

- Refer to this Site SSHP;
- Notify the paramedics and/or fire department, as necessary;

- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area; and
- Stay upwind of any fire.

TABLE 5.1
EMERGENCY CONTACTS

These contacts and maps should be posted prominently at the site. Should any situation or unplanned occurrence require outside assistance or support services, the appropriate contact from the following list should be made:

Agency/Contact		Telephone Number
Police	Memphis Police Dept.	911
Sheriff	Shelby County Sheriff	911
Fire	Memphis Fire Dept.	911
Ambulance	ASI	901-276-2688
Primary Hospital	Regional Medical Center	901-545-8181
Secondary Hospital	Methodist Hospital Central	901-726-7000
Poison Control Center		800-288-9999

Responsible Person	Telephone Number Work	Home
Jimmy Duncan(Parsons ES Proj. Mgr.)	678-969-2375	404-325-7370
Ken Stockwell (Parsons ES Tech. Dir.)	678-969-2351	770-979-5628
Ross Surrency (Parsons ES Site Mgr./ H&S Officer{During Intrusive Investigation})	678-969-2312	678-380-9288
Tamir Klaff (Parsons ES Site Mgr./ H&S Officer {During Geophysical Surveying})	678-969-2492	404-325-9739
Scott Rowden (Parsons ES Project H&S Officer)	678-969-2382	770-822-0520
Wilson Walters (CEHNC Safety Officer)	205-895-1578	TBD
Steve Dunn (CEHNC Project Manager)	205-895-1144	205-828-5639
Shawn Phillips (DDMT Site Contact)	901-544-0611	901-380-1357
Dallys Talley (TEU Emergency Contact)	410-612-8534	See Staff Duty #
TEU - Staff Duty (24 hrs)	410-671-2773	NA
Gary Lattin (ERDEC Emergency Contact)	410-671-4479	717-235-8129
Medical Services Network (Dr. Merlin)	1-800-874-4676, ext. 111	
Barton Regan (ASI Director)	901-276-2688	901-362-6400

TBD = To Be Determined
NA = Not Applicable

5.2.6 Procedures Implemented If Chemical Hazard Detected In Soil Headspace During Intrusive Activities (e.g. Hand Boring, Drilling)

For such instances the following actions will be taken:

- Positive-pressure (slung) escape packs (supplied air) will immediately be used for breathing;
- Plastic sheeting (previously placed next to the boring for immediate use) will be rolled over the boring and bags of sand (also placed next to the boring) will be placed along the edges of the plastic;
- Any open 55-gallon drum containing cuttings will be covered with a drum lid;
- All personnel will then evacuate the area to an upwind location in the support zone;
- Personnel shall then determine whether any personal injury or health emergency exists and take the appropriate measures (see sections 5.2.3 and 5.2.4);
- The soil sample which yielded the positive headspace result will be analyzed by the ERDEC mobile laboratory.
- If results of analysis of the soil sample indicate that the reading was a **false positive** and no chemical agent of concern is present, personnel will return to the drilling location and continue intrusive activities.
- If results of analysis of the soil sample indicate that a **chemical agent of concern is present:**
  1. Parsons ES or ERDEC shall contact the on-site TEU emergency contact. The Site H&S Officer and/or Site Manager shall contact the CEHNC Safety Officer, and the Parsons ES Project H&S Officer (see Table 5.1); and
  2. Parsons ES and their subcontractors will secure the site, taking all necessary precautions to prevent injury to themselves. They will ensure that no-one goes beyond the support zone until TEU arrives and takes control of the site.

5.2.7 Procedures Implemented If Chemical Hazard Detected In Air During Intrusive Activities (e.g. Hand Boring, Drilling)

For such situations the following actions will be taken:

- Positive-pressure (slung) escape packs (supplied air) will immediately be used for breathing;
- Plastic sheeting (previously placed next to the boring for immediate use) will be rolled over the boring and bags of sand (also placed next to the boring) will be placed along the edges of the plastic;
- Any open 55-gallon drum containing cuttings will be covered with a drum lid;
- All personnel will then evacuate the area to an upwind location in the support zone;
- Personnel shall then determine whether any personal injury or health emergency exists and take the appropriate measures (see sections 5.2.3 and 5.2.4);

- Parsons ES or ERDEC shall contact the on-site TEU emergency contact. The Site H&S Officer and/or Site Manager shall contact the CEHNC Safety Officer, and the Parsons ES Project H&S Officer (see Table 5.1); and
- Parsons ES and their subcontractors will secure the site, taking all necessary precautions to prevent injury to themselves. They will ensure that no-one goes beyond the support zone until TEU arrives and takes control of the site.

5.2.8 Directions to Hospitals

5.2.8.1 Primary Hospital

All trauma cases and agent related injuries in Memphis go to the following facility (located approximately 5 miles from the site):

Regional Medical Center
877 Jefferson Avenue
Memphis, TN 38103

Directions to Regional Medical Center:

FROM EAST SIDE OF SITE:

1. From the site, go **north on Airways Boulevard (E PKWY) for approximately 0.9 miles,**
2. Turn **left on Lamar Avenue** (US **78, HWY 4)** heading northwest for **3.0 miles,**
3. Turn **right on Pauline for approx. 1.5 miles,**
4. Turn **left on Jefferson for 0.1 miles,**

FROM WEST SIDE OF SITE:

1. From the site, go **west on Dunn Avenue** for approx. **0.1 miles,**
2. Turn **right on Rose Hill Rd.** and travel west for approx. **0.5 miles,**
3. Turn **right on S Bellevue Blvd (US 51, HWY 3)** heading north for approx. **4 miles,**
4. Turn **left on Madison Ave. heading west for approx. 0.6 miles**
5. Turn **right on Pauline** for 0.2 miles,
6. Turn **leftt on Jefferson** Ave for 0.1 miles.

5.2.8.2 Secondary Hospital

Less severe emergency cases (cuts, breaks, non-critical emergencies) can also be sent to the following facility (located approximately 4.5 miles from the site):

Methodist Hospital Central
1265 Union Avenue
Memphis, TN 38104

Directions to Methodist Hospital Central:

FROM EAST SIDE OF SITE

1. From the site, go **north on Airways BLVD (E PKWY) for approximately 0.9 miles**,
2. Continue on **E PKWY** heading north for **0.2 miles**,
3. Turn **left on Lamar Avenue (US 78, HWY 4)** heading northwest for **2.6 miles**,
4. Turn **right on S Bellevue Blvd (US 51, HWY 3)** heading north **for 0.6 miles**,
5. Turn **right on Eastmoreland**, heading east to Methodist Central ER.

FROM WEST SIDE OF SITE:

1. From the site, go **west on Dunn Avenue** for approx. **0.1 miles**,
2. Turn **right on Rose Hill Rd.** and travel west for approx. **0.5 miles**,
3. Turn **right on S Bellevue Blvd (US 51, HWY 3)** heading north for approx. **4 miles**,
4. Turn **right on Eastmoreland**, heading east to Methodist Central ER.

6.0 STANDARD SAFE WORK PRACTICES

The following are considered standard safe work practices.

1. Eating, drinking, chewing tobacco, smoking, and carrying matches or lighters are prohibited in a contaminated or potentially contaminated area or where the possibility for the contamination transfer exists.
2. Avoid contact with potentially contaminated substances or materials. Do not walk through puddles, pools, mud, or handle soils without protective gloves, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or the ground. Do not place monitoring equipment on potentially contaminated surfaces (e.g., ground, etc.).
3. All field crew members should be alert to all potentially dangerous situations e.g., presence of strong, irritating, unusual (new mown hay or geranium like), or nauseating odors.
4. Field crew members shall be familiar with the physical characteristics of investigations, including:
   - Wind direction in relation to nearby buildings;
   - Accessibility to associates, equipment, vehicles, communication;
   - Hot zone (areas of known or suspected contamination);
   - Site access; and
   - Nearest water sources.
5. Protective equipment as specified in Section 3 will be used by workers during the initial site reconnaissance and follow-on geophysical activities.
6. Use of heavy equipment on-site, e.g., trucks, bobcats, may be hazardous to site workers. For example, the vision of the rig driver may be limited, so all field crew members should stay clear when rigs are operating. Drill rig booms and cables also provide aerial hazards to field crew members.
7. Wearing personal protective equipment can result in an impairment of the ability to operate site equipment. All field crew members should pay specific attention to decreased performance capabilities resulting from the use of personal protective equipment, such as poor tactile skills when wearing certain types of gloves. Prior knowledge of limitations imposed by the use of such equipment will allow the worker to assess the decrease in his or her capability to perform field operations in a safe manner.

8. Wearing of jewelry, such as rings and loose bracelets and necklaces, is prohibited in order to avoid their entanglement in site machinery.

9. Overhead power lines, downed electrical wires, and buried cables pose a danger of shock or electrocution if workers contact or sever them during site operations. The location of these potential hazards should be ascertained before beginning site activities.

10. Buddy system procedures will be enforced during site operations.

11. Site personnel will perform only those tasks which they are qualified to perform.

12. Site visitors are to be escorted by qualified personnel at all times.

13. Running and horseplay are prohibited in all areas of the site.

14. The number of personnel in the work zones will be the minimum number necessary to perform work tasks in a safe and efficient manner.

ATTACHMENT A-1
ACCIDENT REPORT FORM

Project: ______________________

EMPLOYER

1. Name: ______________________
2. Mail Address: ______________________
   (No. and Street) (City or Town) (State and Zip)
3. Location (if different from mail address: ______________________

____

INJURED OR ILL EMPLOYEE

4. Name: ______________________ Social Security No.: ______________
   (first) (middle) (last)
5. Home Address: ______________________
   (No. and Street) (City or Town) (State and Zip)
6. Age: ________ 7. Sex: male ( ) female ( )
8. Occupation: ______________________
   (specific job title, not the specific activity employee was performing at time of injury)
9. Department: ______________________
   (enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident of exposure: ______________________
    (No. and Street) (City or Town) (State and Zip)
11. Was place of accident or exposure on employer's premises? Yes ( ) No ( )
12. What was the employee doing when injured? ______________________
    (be specific–was employee using tools or equipment ______________________ or handling material?)
    ____
13. How did the accident occur? ______________________
    (describe fully the events that resulted in the injury or occupational illness. ______________________ Tell what happened and how. Name objects and substances involved. Give details on all factors that led to ______________________ accident. Use separate sheet for additional space).
14. Time of accident: ______________

15. ES WITNESS TO ACCIDENT ____

(Name) (Affiliation) (Phone No.)

____

(Name) (Affiliation) (Phone No.)

____

(Name) (Affiliation) (Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

16. Describe injury or illness in detail; indicate part of body affected:

____

____

17. Name the object or substance that directly injured the employee. (for example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.).

____

____

18. Date of injury or initial diagnosis of occupational illness: ______________
(date)

19. Did the accident result in employee fatality? Yes ( ) No ( )

20. Number of lost days ____/restricted workdays ____ resulting from injury or illness?

OTHER

21. Name and address of physician:____
(No. and Street) (City or Town) (State and Zip)

22. If hospitalized, name and address:____
(No. and Street) (City or Town) (State and Zip)

Date of report: ____________ Prepared by:______________________________

Official position:________________________

ATTACHMENT A-2
PLAN ACCEPTANCE FORM

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

I have read and agree to abide by the contents of the Health and Safety Plan for the following project:

Operable Unit (OU) 1
Defense Distribution Depot Memphis
Memphis, Tennessee

____

____
Name (print)

____
Signature

____
Date

Return to Site Health and Safety Officer <u>before</u> starting work at the site.

ATTACHMENT A-3
OSHA JOB HEALTH AND SAFETY PROTECTION POSTER

(note: the OSHA job health and safety poster must be displayed prominently at site)

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

There are also provisions for criminal penalties. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta	(404) 347-3573
Boston	(617) 565-7164
Chicago	(312) 353-2220
Dallas	(214) 767-4731
Denver	(303) 844-3061
Kansas	(816) 426-5861
New York	(212) 337-2325
Philadelphia	(215) 596-1201
San Francisco	(415) 995-5672
Seattle	(206) 442-5930

Elizabeth Dole

Elizabeth Dole, Secretary of Labor

Washington, D.C.
1989 (Revised)
OSHA 2203

U.S. Department of Labor

Occupational Safety and Health Administration

U.S. DEPARTMENT OF LABOR

EMPLOYMENT STANDARDS ADMINISTRATION

Wage and Hour Division
Washington, D.C. 20210

ATTACHMENT A-4
Chemical Agent Identification Sets (CAIS)
Information on Set K951/K952

Reference: U.S. Army, November 1995, *Chemical Agent Identification Sets (CAIS) Information Package,* U.S. Army Program Manager for Chemical Demilitarization, Department of Defense.

SET K951/K952

WAR GAS IDENTIFICATION SET, INSTRUCTIONAL M1

SET GAS IDENTIFICATION, DETONATION M1

OLD STOCK NUMBER: FSN 1365-025-3272 (K951)
FSN 1365-025-3783 (K952)

TIME FRAME OF USE: EARLY 1930s TO LATE 1950s

The K951/K952 CAIS contained 48 Pyrex, flame sealed ampules, 12 each containing 1.4 ounce solution of mustard (H, 5 percent in chloroform), Lewisite (L, 5 percent in chloroform), chloropicrin (PS, 50 percent in chloroform), and phosgene (CG) for a total of 26 ounces (0.768 liters) of agent, less the chloroform, per set (see figure 10). The amount of agent and solvent in each ampule is:

Pyrex Ampule	Agent	Chloroform
H	2 ml	38 ml
L	2 ml	38 ml
PS	20 ml	20 ml
CG	40 ml	0 ml

Each ampule is 1 inch in diameter and 7½ inches long. Each ampule is packed in a cardboard screw cap container (mailing tube-type) with agent type indicated by letters on the cardboard container (see figure 11). Twelve cardboard containers each are packaged into 4 press fit metal cans which are 9¼ inches high (see figure 12). The cans are packed into a steel cylinder 6⅝ inches in diameter, approximately 38 inches long, and 0.145 inch thick. The open end of the cylinder is closed by a flanged end cover which is secured by eight bolts (see figure 13).

The only difference between the K951 and K952 is that the K951 was issued with blasting caps that were packed and shipped in a separate container (see figure 14).

The K951 ampules (also called vials) are frequently found in burial sites at old WWII training areas. They are sometimes found loose, sometimes found in their original steel cylinders (also called "pigs") (see figure 13), and are sometimes found in drums, cans, or other disposal containers. When found loose, the agent type cannot be readily identified without sophisticated spectrographic equipment, and a worst case assumption of phosgene should be made by field personnel.

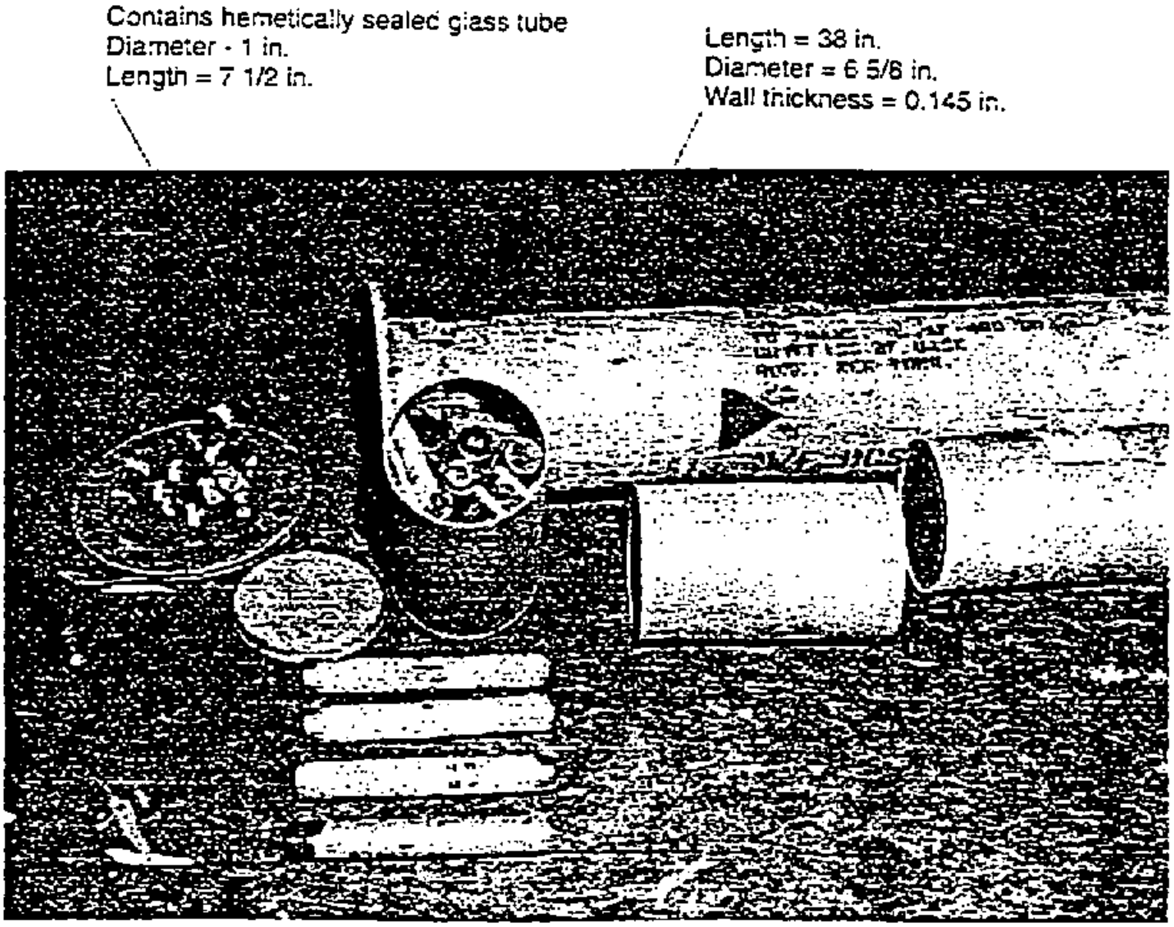


Figure 10. K951 and K952 War Gas Identification Sets

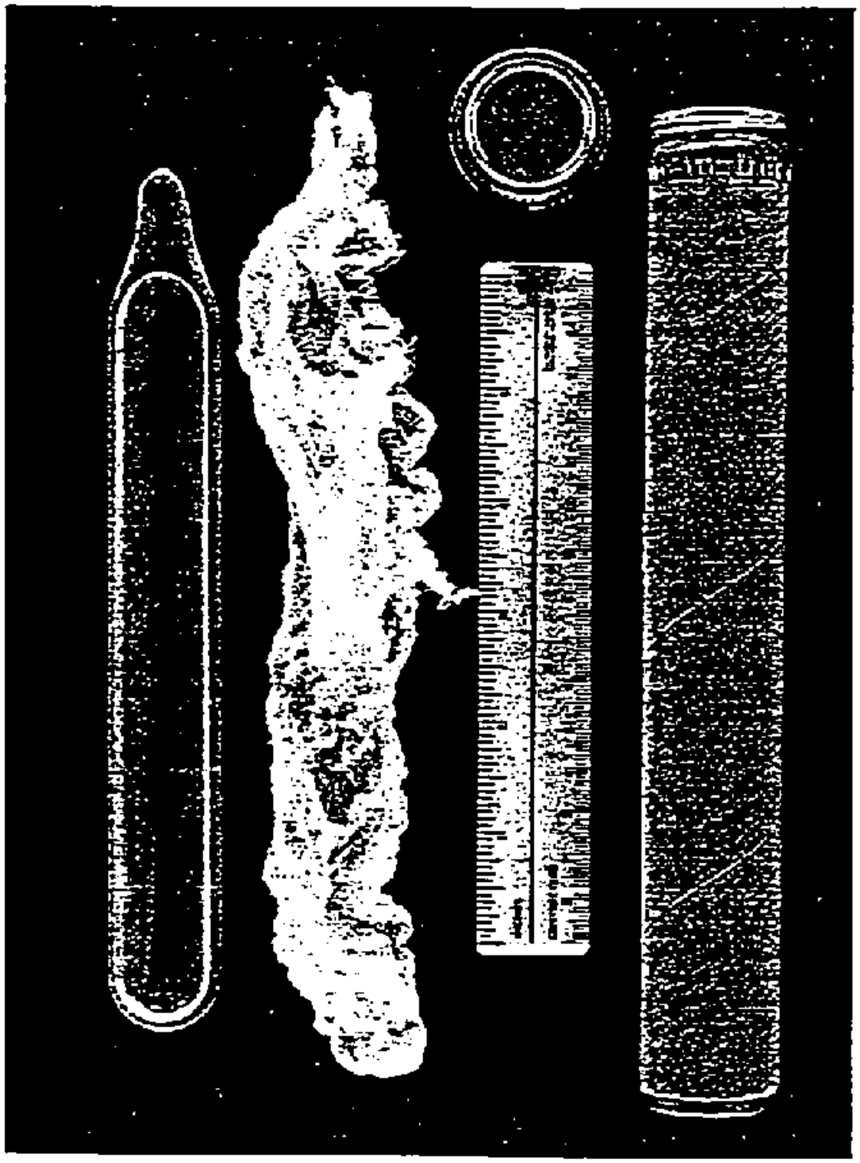


Figure 11. K951/952 Ampule, Packing Material, and Cardboard Container

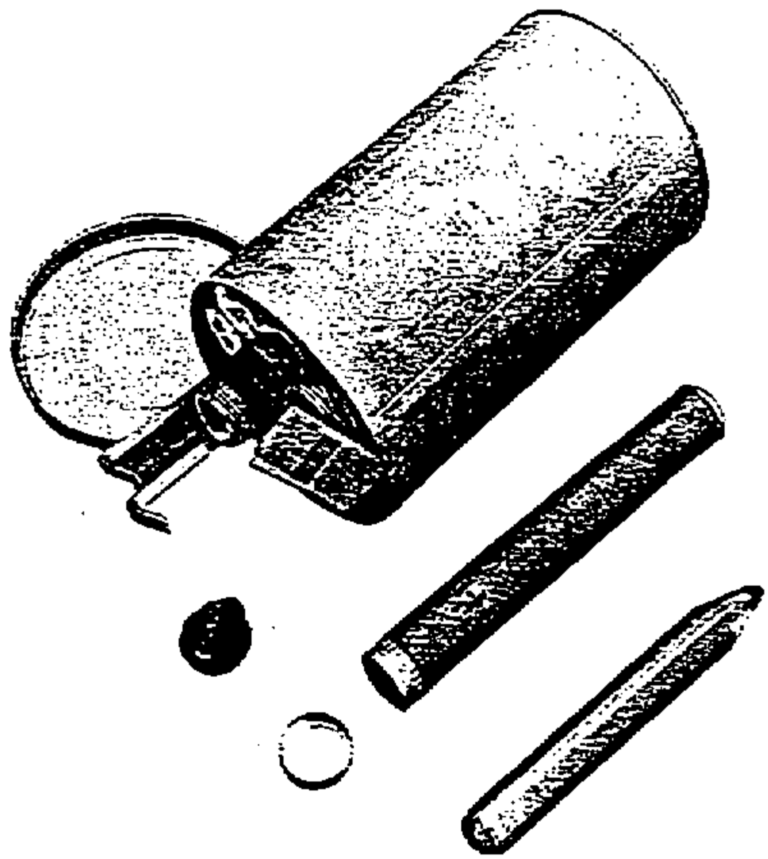


Figure 12. Multiple-Tube Container, Opened

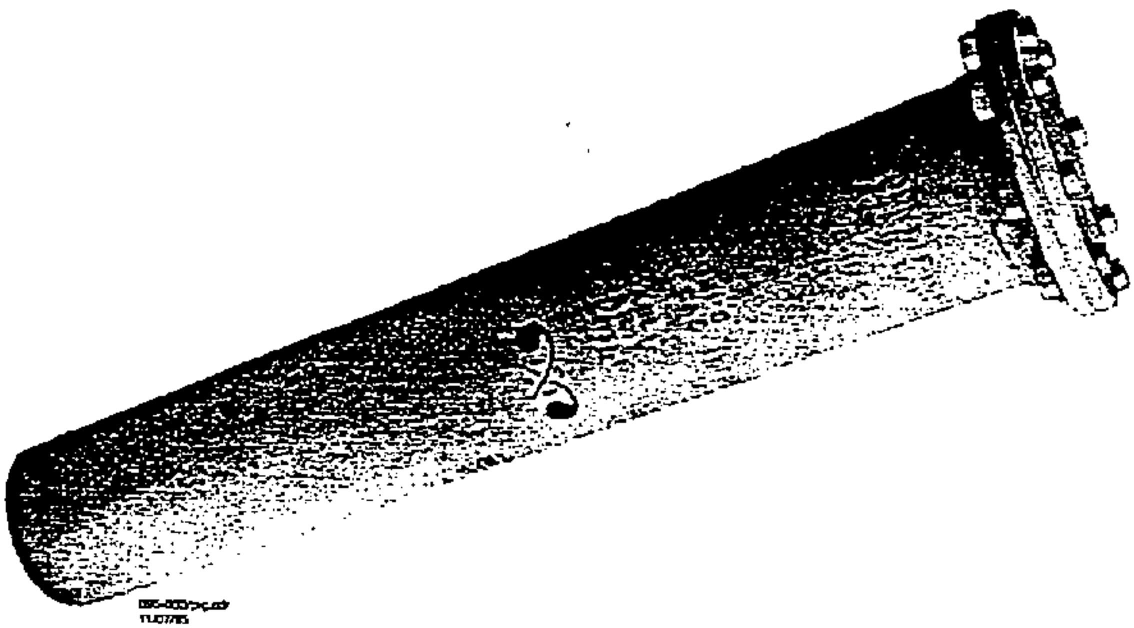


Figure 13. K951/952 Set Closed (Pig)

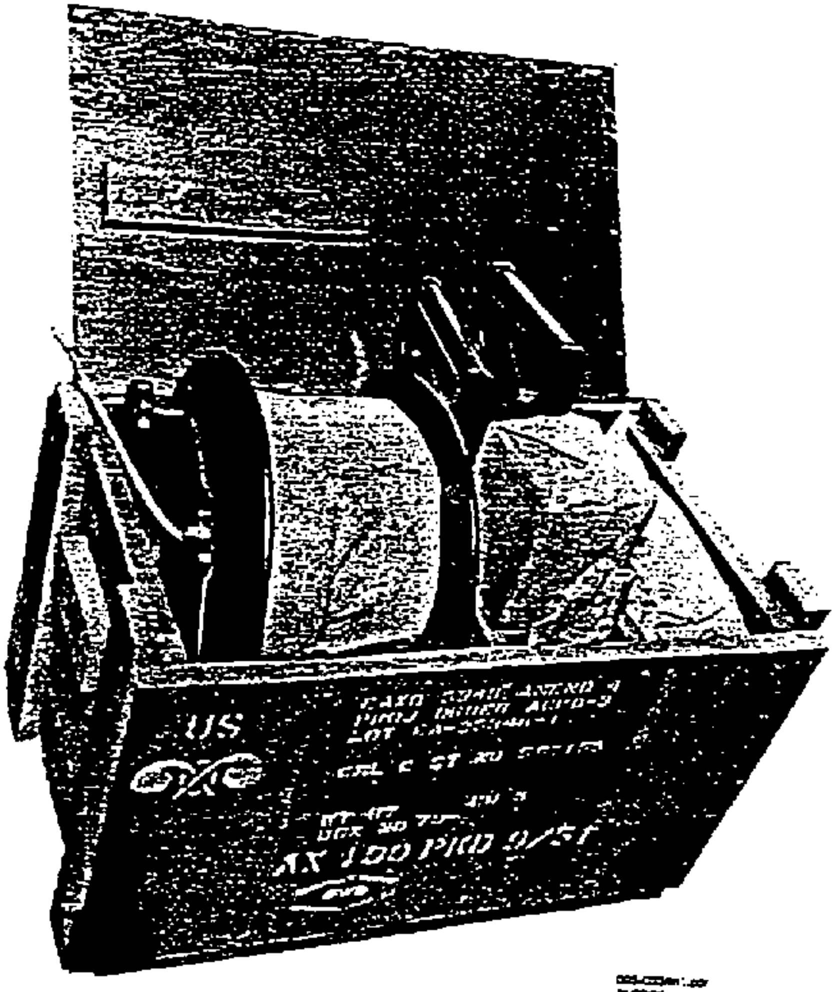


Figure 14. M1 War Gas Identification Detonating Set

ATTACHMENT A-5
Material Safety Data Sheets
for
Mustard (HD), Lewisite (L), Chloropicrin (PS), and Phosgene (CG)

REVISED: 30 June 95
DATE: 22 September 1988
HCSDS NO: 20058A

POISON

U.S. ARMY EDGEWOOD RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

Emergency Telephone #s:
ERDEC Safety Office
410-671-4411 0700-1700
EST After normal duty hours: 410-278-5201
Ask for ERDEC Staff Duty Officer

HD, AND THD (See Addendum A)

MATERIAL SAFETY DATA SHEET

SECTION I - GENERAL INFORMATION

MANUFACTURER'S NAME: Department of the Army

MANUFACTURER'S ADDRESS:
U.S. ARMY CHEMICAL AND BIOLOGICAL DEFENSE COMMAND
EDGEWOOD RESEARCH DEVELOPMENT AND ENGINEERING CENTER
ATTN: SCBRD-ODR-S
ABERDEEN PROVING GROUND, MD 21010-5423

CAS REGISTRY NUMBER: 505-60-2, 39472-40-7, 68157-62-0

CHEMICAL NAME AND SYNONYMS:

Sulfide, bis (2-chloroethyl)
Bis(beta-chloroethyl)sulfide
Bis(2-chloroethyl)sulfide
1-chloro-2(beta-chloroethylthio)ethane
beta, beta'-dichlorodiethyl sulfide
2,2'dichlorodiethyl sulfide
Di-2-chloroethyl sulfide
beta, beta'-dichloroethyl sulfide
2,2'-dichloroethyl sulfide

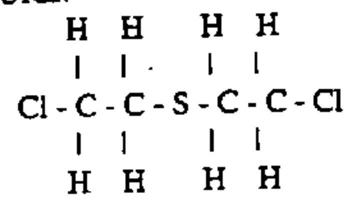
TRADE NAME AND SYNONYMS:

HD	HS	Lost
Senfgas	Iprit	Yellow Cross Liquid
H	Sulphur mustard gas	Mustard Gas
Sulfur mustard	Kampstoff "Lost"	Yperite
S-lost	S-yperite	

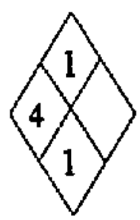
CHEMICAL FAMILY: chlorinated sulfur compound

FORMULA/CHEMICAL STRUCTURE:

$C_4(H_8)Cl_2(S)$



NFPA 704 SIGNAL: Health - 4
Flammability- 1
Reactivity- 1



SECTION II - COMPOSITION

INGREDIENTS NAME	FORMULA	PERCENTAGE BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
Sulfur Mustard	$C_4(H_8)Cl_2(S)$	100	0.003 mg/m^3 (8 hr-TWA)

SECTION III - PHYSICAL DATA

BOILING POINT DEG F (DEG C): 422 DEG F (217 DEG C)

VAPOR PRESSURE (mm Hg): 0.072 mm Hg @ 20 DEG C (0.11 mm Hg @ 25 DEG C)

VAPOR DENSITY (AIR=1): 5.5

SOLUBILITY IN WATER: Negligible. Soluble in acetone, $CH_3(Cl)$, tetrachloroethane, ethylbenzoate, and ether.

SPECIFIC GRAVITY (H_2O=1): 1.27 @ 20 DEG C

FREEZING POINT: 14.45 DEG C

LIQUID DENSITY (g/cc): 1.268 @ 25 DEG C
1.270 @ 20 DEG C

PERCENTAGE VOLATILE BY VOLUME: 610 mg/m^3 @ 20 DEG C
920 mg/m^3 @ 25 DEG C

APPEARANCE AND ODOR: Water clear if pure. Normally pale yellow to black. Slight garlic type odor. The odor threshold for HD is 0.0006 mg/m^3.

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT (METHOD USED): 105 DEG C (ignited by large explosive charges)

FLAMMABILITY LIMITS (% by volume): Unknown

EXTINGUISHING MEDIA: Water, fog, foam, CO_2. Avoid use of extinguishing methods that will splash or spread mustard.

SPECIAL FIRE FIGHTING PROCEDURES: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Fires involving HD should be contained to prevent contamination to uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, fire-fighting personnel should wear full firefighter protective clothing (without TAP clothing) during chemical agent firefighting and fire rescue operations.

Respiratory protection is required. Positive pressure, full facepiece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where fire-fighters are responding to a chemical accident/incident for rescue/reconnaissance purposes vice firefighting, they will wear appropriate levels of protective clothing (see Section 8).

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMIT (AEL): The AEL for HD is 0.003 mg/m^3 as found in "AR 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, HT". To date, however, the Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure concentration for HD.

EFFECTS OF OVEREXPOSURE: HD is a vesicant (causing blisters) and alkylating agent producing cytotoxic action on the hematopoietic (blood-forming) tissues which are especially sensitive. The rate of detoxification of HD in the body is very slow and repeated exposures produce a cumulative effect. HD has been found to be a human carcinogen by the International Agency for Research on Cancer (IARC).

Median doses of HD in man are:

LD_{50} (skin) = 100 mg/kg
ICt_{50} (skin) = 2000 mg-min/m^3 at 70 - 80 DEG F (humid environment)
= 1000 mg-min/m^3 at 90 DEG F (dry environment)
ICt_{50} (eyes) = 200 mg-min/m^3
ICt_{50} (inhalation) = 1500 mg-min/m^3 (Ct unchanged with time)
LD_{50} (oral) = 0.7 mg/kg

Maximum safe Ct for skin and eyes are 5 and 2 mg-min/m^3, respectively.

ACUTE PHYSIOLOGICAL ACTION OF HD IS CLASSIFIED AS LOCAL AND SYSTEMIC.

LOCALLY, HD affects both the eyes and the skin. SKIN damage occurs after percutaneous resorption. Being lipid soluble, HD can be resorbed into all organs. Skin penetration is rapid without skin irritation. Swelling (blisters) and reddening (erythema) of the skin occurs after a latency period of 4-24 hours following the exposure, depending on degree of exposure and individual sensitivity. The skin healing process is very slow. Tender skin, mucous membrane, and perspiration-covered skin are more sensitive to the effects of HD. HD's effect on the skin, however, is less than on the eyes. Local action on the eyes produces severe necrotic damage and loss of eyesight. Exposure of eyes to HD vapor or aerosol produces lacrimation, photophobia, and inflammation of the conjunctiva and cornea.

SYSTEMIC ACTIONS occur primarily through inhalation and ingestion. The HD vapor or aerosol is less toxic to the skin or eyes than the liquid form. When inhaled, the upper respiratory tract (nose, throat, trachea) is inflamed after a few hours latency period, accompanied by sneezing, coughing, and bronchitis, loss of appetite, diarrhea, fever, and apathy. Exposure to nearly lethal dose of HD can produce injury to bone marrow, lymph nodes, and spleen as indicated by a drop in WBC count and, therefore, results in increased susceptibility to local and systemic infections. Ingestion of HD will produce severe stomach pains, vomiting, and bloody stools after a 15-20 minute latency period.

CHRONIC EXPOSURE to HD can cause sensitization, chronic lung impairment, (cough, shortness of breath, chest pain), and cancer of the mouth, throat, respiratory tract, skin, and leukemia. It may also cause birth defects.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION. Remove from the source IMMEDIATELY. If breathing has stopped, give artificial respiration. If breathing is difficult, administer oxygen. Seek medical attention IMMEDIATELY.

EYE CONTACT. Speed in decontaminating the eyes is absolutely essential. Remove person from the liquid source, flush the eyes immediately with water by tilting the head to the side, pulling the eyelids apart with the fingers and pouring water slowly into the eyes. Do not cover eyes with bandages but, if necessary, protect eyes by means of dark or opaque goggles. Transfer the patient to a medical facility IMMEDIATELY.

SKIN CONTACT. Don respiratory protective mask and gloves; remove victim from agent source immediately. Flush skin and clothes with 5 percent solution of sodium hypochlorite or liquid household bleach within one minute. Cut and remove contaminated clothing, flush contaminated skin area again with 5 percent sodium hypochlorite solution, then wash contaminated skin area with soap and water. If shower facilities are available, wash thoroughly and transfer to medical facility. If the skin becomes contaminated with a thickened agent, blot/wipe the material off immediately with an absorbent pad/paper towel prior to using decontaminating solution.

INGESTION. Do not induce vomiting. Give victim milk to drink. Seek medical attention IMMEDIATELY.

SECTION VI - REACTIVITY DATA

STABILITY: Stable at ambient temperatures. Decomposition temperature is 149 DEG C to 177 DEG C. Mustard is a persistent agent depending on pH and moisture, and has been known to remain active for up to three years in soil.

INCOMPATIBILITY: Conditions to avoid. Rapidly corrosive to brass @ 65 DEG C. Will corrode steel at a rate of .0001 in. of steel per month @ 65 DEG C.

HAZARDOUS DECOMPOSITION: Mustard will hydrolyze to form HCl and thiodiglycol.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Only personnel in full protective clothing (see Section 8) will be allowed in an area where mustard is spilled.

RECOMMENDED FIELD PROCEDURES:
The mustard should be contained using vermiculite, diatomaceous earth, clay or fine sand and neutralized as soon as possible using copious amounts of 5.25 percent Sodium Hypochlorite solution.

Scoop up all material and place in an approved DOT container. Cover the contents of the drum with decontaminating solution as above. The exterior of the drum shall be decontaminated and then labeled IAW EPA and DOT regulations. All leaking containers shall be overpacked with vermiculite placed between the interior and exterior containers. Decontaminate and label IAW EPA and DOT regulations. Dispose of the material IAW waste disposal methods provided below. Dispose of the material used to decontaminate exterior of drum IAW Federal, state and local regulations. Conduct general area monitoring with an approved monitor (see Section 8) to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (see Sections 2 and 8).

If 5.25 percent Sodium Hypochlorite solution is not available then the following decontaminants may be used instead and are listed in the order of preference: Calcium Hypochlorite, Decontamination Solution No. 2 (DS2), and Super Tropical Bleach Slurry (STB). WARNING: Pure, undiluted Calcium Hypochlorite (HTH) will burn on contact with liquid blister agent.

RECOMMENDED LABORATORY PROCEDURES:
A minimum of 65 grams of decon solution per gram of HD is allowed to agitate for a minimum of one hour. Agitation is not necessary following the first hour if a single phase is obtained. At the end of 24 hours, the resulting solution shall be adjusted to a pH between 10 and 11. Test for presence of active chlorine by use of acidic potassium iodide solution to give free iodine color. Place 3 ml of the decontaminate in a test tube. Add several crystals of Potassium Iodine and swirl to dissolve. Add 3 ml of 50 wt percent Sulfuric Acid: water and swirl. IMMEDIATE Iodine color indicates the presence of active chlorine. If negative, add additional 5.25 percent Sodium Hypochlorite solution to the decontamination solution, wait two hours, then test again for active chlorine. Continue procedure until positive chlorine is given by solution.

A 10 wt percent Calcium hypochlorite (HTH) mixture may be substituted for Sodium Hypochlorite. Use 65 grams of decon per gram of HD and continue the test as described for Sodium Hypochlorite.

Scoop up all material and place in approved DOT containers. Cover the contents of the drum with decontaminating solution as above. The exterior of the drum shall be decontaminated and then labeled IAW EPA and DOT regulations. All leaking containers shall be overpacked with vermiculite placed between the interior and exterior containers. Decontaminate and label IAW EPA and DOT regulations. Dispose of the material IAW waste disposal methods provided below. Dispose of the material used to decontaminate exterior of drum IAW Federal, state and local regulations. Conduct general area monitoring with an approved monitor (see Section 8) to confirm that the atmospheric concentrations do not exceed the airborne exposure limits (see Section 8).

NOTE: Surfaces contaminated with HD and then rinse-decontaminated may evolve sufficient mustard vapor to produce a physiological response.

WASTE DISPOSAL METHOD: All decontaminated material should be collected, contained and chemically decontaminated or thermally decomposed in an EPA approved incinerator, which will filter or scrub toxic by-products from effluent air before discharge to the atmosphere. Any contaminated protective clothing should be decontaminated using HTH or bleach and analyzed to assure it is free of detectable contamination (3X) level. The clothing should then be sealed in plastic bags inside properly labeled drums and held for shipment back to the DA issue point. Decontamination of waste or excess material shall be accomplished in accordance with the procedures outlined above with the following exception:

— HD on laboratory glassware may be oxidized by its vigorous reaction with concentrated nitric acid.

Open pit burning or burying of HD or items containing or contaminated with HD in any quantity is prohibited.

NOTE: Some states define decontaminated surety material as a RCRA hazardous waste.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

Concentration mg/m3	Respiratory Protection/Ensemble Required
Less than or equal to 0.003	A full facepiece, chemical canister, air-purifying protective mask will be onhand for escape. (The M9-, M17-, and M40-series masks are acceptable for this purpose. Other masks certified as equivalent may be used.)
Greater than 0.003	NIOSH/MSHA approved pressure demand full facepiece SCBA suitable for use in high agent concentrations with protective ensemble. (See DA PAM 385-61 for examples).

VENTILATION:

Local Exhaust. Mandatory. Must be filtered or scrubbed. Air emissions shall meet local, state and federal regulations.

Special. Chemical laboratory hoods shall have an average inward face velocity of 100 linear feet per minute (lfpm) plus or minus 10% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods shall have an inward face velocity of 150 lfpm plus or minus 20 percent. Laboratory hoods shall be located such that cross drafts do not exceed 20% of the inward face velocity. A visual performance test utilizing smoke producing devices shall be performed in assessing the ability of the hood to contain agent HD.

Other. Recirculation of exhaust air from agent areas is prohibited. No connection between agent area and other areas through the ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested semi-annually or after modification or maintenance operations. Operations should be performed 20 cm inside hoods.

PROTECTIVE GLOVES: MANDATORY. Butyl toxicological agent protective gloves (M3, M4, gloveset).

EYE PROTECTION: As a minimum, chemical goggles will be worn. For splash hazard use goggles and face-shield.

OTHER PROTECTIVE EQUIPMENT: For general lab work, gloves and lab coat shall be worn with M9 or M17 mask readily available.

In addition, when handling contaminated lab animals, a daily clean smock, foot covers, and head covers are required.

MONITORING: Available monitoring equipment for agent HD is the M8/M9 detector paper, blue band tube, M256/M256A1 kits, bubbler, Depot Area Air Monitoring System (DAMMS), Automated Continuous Air Monitoring System (ACAMS), CAM-M1, Hydrogen Flame Photometric Emission Detector (HYFED), the Miniature Chemical Agent Monitor (MINICAM), and Real Time Analytical Platform (RTAP).

Real-time, low-level monitors (with alarm) are required for HD operations. In their absence, an IDLH atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:
During handling, the "buddy" (two-man) system will be used. Containers should be periodically inspected for leaks, either visually or using a detector kit, and prior to transfering the containers from storage to work areas. Stringent control over all personnel handling HD must be exercised. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided. Each worker will wash their hands before meals and shower thoroughly with special attention given to hair, face, neck, and hands using plenty of soap before leaving at the end of the work day. No smoking, eating, or drinking is permitted at the work site. Decontaminating equipment shall be conveniently located. Exits must be designed to permit rapid evacuation. HD should be stored in containers made of glass for Research, Development, Test and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent shall be double-contained in liquid-tight containers when in storage.

OTHER PRECAUTIONS: For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program", "DA PAM 385-61, Toxic Chemical Agent Safety Standards", and "AR

40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT".

SECTION X - TRANSPORTATION DATA

FORBIDDEN FOR TRANSPORT OTHER THAN VIA MILITARY (TECHNICAL ESCORT UNIT)

TRANSPORT AS PER 49 CFR 172

PROPER SHIPPING NAME: Poisonous liquids, n.o.s.(Sulfide, bis2-chloroethyl)

DOT HAZARD CLASS: 6.1 Packing Group I Hazard Zone B

DOT LABEL: Poison

DOT MARKING: Poisonous liquids, n.o.s. (Sulfide, bis 2-chloroethyl) UN 2810, Inhalation Hazard

DOT PLACARD: POISON

EMERGENCY ACCIDENT PRECAUTIONS AND PROCEDURES: See Sections IV and VIII.

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Driver shall be given full and complete information regarding shipment and conditions in case of emergency. AR 50-6 deals specifically with the shipment of chemical agents. Shipment of agents will be escorted in accordance with AR 740-32.

ADDENDUM A
ADDITIONAL INFORMATION FOR THICKENED HD

TRADE NAME AND SYNONYMS: Thickened HD, THD

HAZARDOUS INGREDIENTS: K125 (acryloid copolymer, 5%) is used to thicken HD. K125 is not known to be hazardous except in a finely-divided, powder form.

PHYSICAL DATA: Essentially the same as HD except for viscosity. The viscosity of HD is between 1000 and 1200 centistokes @ 25 DEG C.

FIRE AND EXPLOSION DATA: Same as HD.

HEALTH HAZARD DATA: Same as HD except for skin contact. For skin contact, don respiratory protective mask and remove contaminated clothing IMMEDIATELY. IMMEDIATELY scrape the HD from the skin surface, then wash the contaminated surface with acetone. Seek medical attention IMMEDIATELY.

SPILL, LEAK, AND DISPOSAL PROCEDURES: If spills or leaks of HV occur, follow the same procedures as those for HD, but dissolve the THD in acetone prior to introducing any decontaminating solution. Containment of THD is generally not necessary. Spilled THD can be carefully scraped off the contaminated surface and placed in a fully removable head drum with a high density, polyethylene lining. The THD can then be decontaminated, after it has been dissolved in acetone, using the same procedures used for HD. Contaminated surfaces should be treated with acetone, then decontaminated using the same procedures as those used for HD.

NOTE: Surfaces contaminated with THD or HD and then rinse-decontaminated may evolve sufficient mustard vapor to produce a physiological response.

SPECIAL PROTECTION INFORMATION: Same as HD.

SPECIAL PRECAUTIONS: Same as HD with the following addition. Handling the THD requires careful observation of the "stringers" (elastic, thread-like attachments) formed when the agents are transferred or dispensed. These stringers must be broken cleanly before moving the contaminating device or dispensing device to another location, or unwanted contamination of a working surface will result.

TRANSPORTATION DATA: Same as HD.

REVISED: 30 June 95
DATE: 16 April 1988

POISON

U.S. ARMY EDGEWOOD
RESEARCH, DEVELOPMENT
AND ENGINEERING CENTER

MATERIAL SAFETY DATA SHEET

Emergency Telephone #s:
ERDEC Safety Office
410-671-4411 0700-1700
EST After normal duty
hours: 410-278-5201
Ask for ERDEC Staff
DutyOfficer

LEWISITE

SECTION I - GENERAL INFORMATION

MANUFACTURER'S NAME: Edgewood Research, Development and Engineering Center

MANUFACTURER'S ADDRESS:
U.S. ARMY CHEMICAL AND BIOLOGICAL DEFENSE COMMAND
EDGEWOOD RESEARCH, DEVELOPMENT & ENGINEERING CENTER
ATTN: SCBRD-ODR-S
ABERDEEN PROVING GROUND, MD 21010-5423

CAS REGISTRY NUMBER: 541-25-3

CHEMICAL NAME AND SYNONYMS:

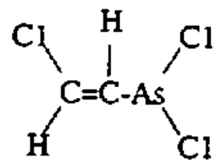
Arsine, (2-chlorovinyl) dichloro-
Arsonous dichloride, (2-chloroethenyl)-
Chlorovinylarsine dichloride
2-Chlorovinyldichloroarsine
beta-Chlorovinyldichloroarsine
Dichloro (2-chlorovinyl) arsine

TRADE NAME AND SYNONYMS: Lewisite, L, EA 1034

CHEMICAL FAMILY: Arsenical (vesicant)

FORMULA/CHEMICAL STRUCTURE:

$C_2H_2AsCl_3$



NFPA 702 SIGNAL: Health - 4
Flammability - 1
Reactivity - 1

SECTION II - COMPOSITION

INGREDIENTS NAME	FORMULA	PERCENTAGE BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
Lewisite	$C_2H_2AsCl_3$	100	* 0.003 mg/m^3

* This is a ceiling value

SECTION III - PHYSICAL DATA

BOILING POINT DEG F (DEG C): 374 (190)

VAPOR PRESSURE (mm Hg): 0.35 @ 25 DEG C
0.22 @ 20 DEG C

VAPOR DENSITY (AIR=1): 7.2

SOLUBILITY: Negligible in water, completely soluble in Et_2O, $CHCl_3$, all common organic solvents, mustard, oils, and alcohol.

SPECIFIC GRAVITY (H_2O=1): 1.88 @ 25 DEG C

VOLATILITY (mg/m^3): $3.9 \times (10)^3$ @ 25 DEG C
$2.5 \times (10)^3$ @ 20 DEG C

MOLECULAR WEIGHT: 207.32

APPEARANCE AND ODOR: Pure L is a colorless oily liquid. "War gas" is an amber to dark brown liquid; characteristic odor is usually geranium-like; very little odor when pure.

SECTION IV- FIRE AND EXPLOSION DATA

FLASHPOINT (Method Used): Does not flash

FLAMMABILITY LIMITS: N/A.

EXTINGUISHING MEDIA: N/A.

SPECIAL FIRE FIGHTING PROCEDURES: Fires involving L should be contained to prevent contamination of uncontrolled areas. All persons not engaged in extinguishing the fire should be evacuated immediately. Contact with L or its vapors can be fatal. When responding to a fire alarm in building or areas containing agents, firefighting personnel should wear full firefighter protective clothing during chemical agent firefighting and fire rescue operations. Respiratory protection is required. Positive pressure, full facepiece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes vice firefighting, they will wear appropriate levels of protective clothing (see Section 8).

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMIT (AEL): The permissible airborne exposure concentration of L for an 8-hour workday or a 40-hour work week is an 8-hour time weighted average (TWA) of 0.003 mg/m^3 as a ceiling value. A ceiling value may not be exceeded at any time. The ceiling value for Lewisite is based upon the present technologically feasible detection limit of 0.003 mg/m^3. This value can be found in "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard H, HD, HT, and L". To date, however, the Occupational Safety and Health Administration (OSHA) has not promulgated permissible exposure concentration for L.

EFFECTS OF OVEREXPOSURE: L is a vesicant (blister agent). It also acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure. In order of severity and appearance of symptoms, it is: a blister agent, a toxic lung irritant, and absorbed in tissues, a systemic poison. When inhaled in high concentrations, it may be fatal in as short a time as 10 minutes. L is not detoxified by the body. Common routes of entry into the body include occular, percutaneous, and inhalation.

LCt_{50} (inhalation, man) = 1200 - 1500 mg min/m^3
LCt_{50} (skin vapor exposure, man) = 100,000 mg min/m^3
LDLO (skin, human) = 20 mg/kg
LCt_{50} (skin, man): >1500 mg/min^3. L irritates eyes and skin and gives warning of its presence.
Minimum effective dose (ED min) = 200 mg/m^3 (30 min).
ICt_{50} (eyes, man): <300 mg min/m^3.

ANIMAL TOXICOLOGICAL DATA:

LD_{50} (oral, rat) = 50 mg/kg
LD_{50} (subcutaneous, rat) = 1 mg/kg
LCtLO (inhalation, mouse) = 150 mg/m^3 10m
LD_{50} (skin, dog = 15 mg/kg RTECS) or 38 mg/kg (CRDEC chemical agent data sheets)
LD_{50} (skin, rabbit) = 6 mg/kg
LD_{50} (subcutaneous, rabbit) = 2 mg/kg
LD_{50} (intravenous, rabbit) = 500 mg/kg
LD_{50} (skin, guineapig) = 12 mg/kg
LD_{50} (subcutaneous, guinea pig) = 1 mg/kg
LD_{50} (skin, domestic farm animals) = 15 mg/kg
LCt_{50} (inhalation, rat) = 1500 mg min/m3 (9 min)
LCt_{50} (vapor skin, rat) = 20,000 mg min m (25 min)
LCD_{50} (skin, rat) = 15 - 24 mg/kg
LD_{50} (ip, dog) = 2 mg/kg
EDmin (skin, dog) = 50 mg/m3 (30 min)
EDmin (eye, dog) = 20 mg/m3 (30 min)
EDmin (skin, rabbit) = 25 mg/m3 (30 min)
EDmin (eye, rabbit) = 1 mg/m3 (30 min)

a. Acute Exposure:

(1) Eyes. Severe damage. Instant pain, conjunctivitis and blepharospasm leading to closure of eyelids, followed by corneal scarring and iritis. Mild exposure produces reversible eye damage if decontaminated instantly, otherwise more permanent injury or blindness is possible within 1 minute of exposure.

(2) Skin. Immediate stinging pain increasing in severity with time. Erythema (skin reddening) appears within 30 minutes after exposure accompained by pain with itching and irritation for 24 hours. Blisters appear within 12 hours after exposure with more pain which diminished after 2-3 days. Skin burns are much deeper than with HD. Tender and moist skin (mucous membrane, perspiration covered;...) absorb more L and are therefore more sensitive than the skin. This, however, is counteracted by L's hydrolysis by moisture, producing less vesicant and a higher vapor pressure product.

(3) Respiratory Tract. Irritating to nasal passages and produces a burning sensation followed by a profuse nasal secretion and violent sneezing. Prolonged exposure causes coughing and production of large quantities of froth mucus. In experimental animals, injury to respiratory tract, due to vapor exposure is similar to mustard's; however, edema of the lung is more marked and frequently accompanied by pleural fluid.

(4) Systemic Effects. L on the skin, as well as in inhaled vapor, are absorbed and may cause systemic poisoning. A manifestation of this is a change in capillary permeability, which permits loss of sufficient fluid from the bloodstream to cause hemoconcentration, shock and death. In non-fatal cases, hemolysis of erythrocytes has occurred with a resultant hemolytic anemia. The excretion of oxidized products into the bile by the liver produces focal necrosis of that organ, necrosis of the mucosa of the biliary passages with periobiliary hemorrhages, and some injury to the intestinal mucosa. Acute systematic poisoning from large skin burns causes pulmonary edema, diarrhea, restlessness weakness, subnormal temperanure, and low blood pressure in animals.

b. Chronic Exposure. L can cause sensitization and chronic lung impairement. Also, by comparison to agent mustard and arsenical compounds,it can be considered as a suspected human carcinogen.

EMERGENCY AND FIRST AID PROCEDURES: Always don your own protective mask and gloves before administering first aid.

INHALATION: Remove from the source immediately. If breathing has stopped give artifical respiration. If breathing is difficult, administer oxygen. Seek medical attention immediately.

EYE CONTACT: Speed in decontaminating the eyes is absolutely essential. Remove person from the liquid source, flush the eyes immediately with water for 10-15 minutes by tilting the head to the side, pulling eyelids apart with fingers and pouring water slowly into the eyes. Do not cover eyes with bandages but, if necessary, protect eyes by means of dark or opaque goggles. See medical attention IMMEDIATELY.

SKIN CONTACT: Remove victim from source immediately and remove contaminated clothing. Immediately decon affected areas by flushing with 10 percent sodium carbonate solution. After 3-4 minutes, wash off with soap and water to protect against erythema. Seek medical attention immediately.

INGESTION: Do not induce vomiting. Give victim milk to drink. Seek medical attention immediately.

SECTION VI - REACTIVITY DATA

INCOMPATIBILITY: Corrosive to steel at a rate of 1×10^{-5} to 5×10^{-5} in/month at 65 DEG C.

HAZARDOUS DECOMPOSITION PRODUCTS:
Stability: Reasonably stable; however, in presence of moisture, it hydrolyses rapidly, losing its vesicant property. It also hydrolyses in acidic medium to form HCl and non-volatile (solid) chlorovinylarsenious oxide, which is less vesicant than Lewisite. Hydrolysis in alkaline medium, as in decontamination with alcoholic caustic or carbonate solution or DS2, produces acetylene and trisodium arsenate (Na_3 AS 0_4). Therefore, decontaminated solution would contain toxic arsenic.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
Only personnel in full protective clothing will be allowed in area where L is spilled (see Section 8).

RECOMMENDED FIELD PROCEDURES: The L should be contained using vermiculite, diatomaceous earth, clay, or fine sand and neutralized as soon as possible using copious amounts of alcoholic caustic, carbonate, or DS2. Caution must be exercised when using these decontaminates since acetylene will be given off. Household bleach can also be used if accompanied by stirring to allow contact. Scoop up all contaminated material and place in approved DOT containers. Cover with additional decontaminant. Decontaminate the outside of the container, label IAW DOT and EPA requirements, and dispose of as specified below. Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (see Sections 2 and 8).

RECOMMENDED LABORATORY PROCEDURES: A 10 wt percent alcoholic Sodium Hydroxide solution is prepared by adding 100 grams of denatured ethanol to 900 grams of 10 wt percent NaOH in water. A minimum of 200 grams of decon is required for each gram of L. The decon/agent solution is agitated for a minimum of one (1) hour. At the end of one hour the resulting pH should be checked and adjusted to above 11.5 using additional NaOH, if required.

It is permitted to substitute 10 wt percent alcoholic sodium carbonate made and used in the same ratio as the NaOH listed above. Reaction time should be increased to 3 hours with agitation for the first hour. Final pH should be adjusted to above 10.

It is permitted to substitute 5.25 percent sodium hypochlorite for the 10 percent alcoholic sodium hydroxide solution above. Allow one hour with agitation for the reaction. Adjustment of the pH is not required.

Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (see Section 8).

WASTE DISPOSAL METHOD:
All neutralized material should be collected and contained for disposal IAW land ban RCRA regulations or thermally decomposed in an EPA permitted incinerator equipped with a scrubber which will scrub out the chlorides and be equipped with an electrostatic precipitator or other filter device to remove arsenic. Collect all the arsenic dust from the electrostatic precipitator or other filter device and containerize and label IAW DOT and EPA regulations. The arsenic will be disposed of IAW land ban RCRA regulations. Any contaminated materials or protective clothing should be decontaminated using alcoholic caustic, carbonate, or bleach analyzed to assure it is free of detectable contamination (3X) level. The clothing should then be sealed in plastic bags inside properly labeled drums and held for shipment back to the DA issue point.

NOTE: Some states define decontaminated surety material as a RCRA hazardous waste.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

Concentration (mg/m^3)	Respiratory Protection/Ensemble Required
Less than or equal to 0.003	A full facepiece, chemical canister, air-purifying, protective mask shall be on hand for escape (the M9, M17 and M40 series protective masks are acceptable for this use).
Greater than 0.003 or unknown	A NIOSH/MSHA-approved, full facepiece SCBA suitable for use in high agent concentrations with protective ensemble. (See DA Pam 385-61)

* This represents the ceiling value determined by continuous real time monitoring (with alarm) at the 0.003 mg/m^3 level of detection.

VENTILATION: Local exhaust - Mandatory, must be filtered or scrubbed to limit exit concentration to non-detectable level. Air emissions shall meet local, state and federal regulations.

Special: Chemical laboratory hoods shall have an average inward face velocity of 100 linear feet per minute (1fpm) + 10% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods shall have an inward face velocity of 150 1fpm plus or minus 20 percent. Laboratory hoods shall be located such that cross drafts do not exceed 20 % of the inward face velocity. A visual performance test utilizing smoke producing devices shall be performed in the assessment of the inclosure's ability to contain Lewisite.

Other: Recirculation of exhaust air form agent areas is prohibited. No connection between agent area and other areas through the ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested semi-annually or after modification or maintenance operations. Operations should be performed 20 cm inside hoods. Procedures should be developed for disposal of contaminated filters.

PROTECTIVE GLOVES: Norton, Chemical Protective Glove Set M3 Butyl Rubber

EYE PROTECTION: As a minimum, protective eye glasses will be worn. For splash hazard use goggles and face-shield.

OTHER PROTECTIVE EQUIPMENT: For laboratory operations, gloves and lab coat will be worn with M9, M17, or M40 mask readily available.

MONITORING: Available monitoring equipment for agent L is the M18A2 (yellow band), bubblers (arsenic and GC method), and M256 & A1 Kits.

Real-time, low-level monitors (with alarm) are required for L operations. In their absence, an IDLH atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:
During handling, the "buddy" (two man) system will be used. Containers should be periodically inspected for leaks, either visually or using a detector kit. Stringent control over all personnel handling L must be exercised. Chemical showers, eye wash stations, and personal cleanliness facilities must be provided; wash hands before meals and each worker will shower thoroughly with special attention given to hair, face, neck, and hands, using plenty of soap before leaving at the end of the workday. The storage or consumption of food or beverages; the storage or application of cosmetics; the smoking or storage of smoking materials, tobacco products or other products for chewing; or the chewing of such product in all laboratory areas, is prohibited. Laboratory glasswear will not be used to prepare or consume food or beverages. Decontaminating equipment shall be conveniently located. Exits must be designed to permit rapid evacuation. L should be stored in containers made of glass for Research, Development Test and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent shall be double contained in liquid tight containers when in storage or during transportation.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program", "DA Pam 385-61, Toxic Chemical Agent Safety Standards", and "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard H, HD, HT, and L".

SECTION X - TRANSPORTATION DATA

PROPER SHIPPING NAME: Poisonous liquids, n.o.s. (Chlorovinylarsine dichloride)

DOT HAZARD CLASSIFICATION: 6.1, Packing Group I

DOT LABEL: Poison

DOT MARKING: Poisonous liquids, n.o.s. (Chlorovinylarsine dichloride) UN 2810

DOT PLACARD: Poison

EMERGENCY ACCIDENT PRECAUTIONS & PROCEDURES: See Sections IV and VIII.

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Driver shall be given full and complete information regarding shipment and conditions in case of emergency. AR 50-6 deals specifically with the shipment of chemical agents. Shipment of agents will be escorted in accordance with AR 740-32.

While the Edgewood Research, Development and Engineering Center, Department of the Army believes that the data contained herein are factual and the opinions expressed are those of qualified experts regarding the results of the tests conducted, the data are not to be taken as a warranty or representation for which the Department of the Army or Edgewood Research, Development and Engineering Center assumes legal responsibility. They are offered solely for your consideration, investigation, and verification. Any use of these data and information must be determined by the user to be in accordance with applicable Federal, State, and local laws and regulations.

REVISED: 12 December 90

POISON

OCCUPATIONAL
HEALTH SERVICES, INC.

Emergency Telephone #s:
818-366-2000

CHLOROPICRIN

MATERIAL SAFETY DATA SHEET

SECTION I - GENERAL INFORMATION

MANUFACTURER'S NAME:
OCCUPATIONAL HEALTH SERVICES, INC.

MANUFACTURER'S ADDRESS:
OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NY 10036
800-445-MSDS OR 212-789-3535

CAS REGISTRY NUMBER: 76-06-2

CHEMICAL NAME AND SYNONYMS:

Trichloronitromethane
Nitrochloroform
Chloropicrin
Nitrotrichloromethane

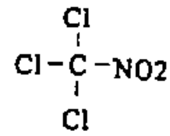
TRADE NAME AND SYNONYMS:

Chloropicrin
PS

CHEMICAL FAMILY: Nitro (Aliphatic halogen compound)

FORMULA/CHEMICAL STRUCTURE:

CCl_3NO_2



NFPA 704 SIGNAL:

	Health -	4
	Flammability -	0
	Reactivity -	3

SECTION II - COMPOSITION

INGREDIENTS NAME	FORMULA	PERCENTAGE BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
Chloropicrin	CCl_3NO_2	100	0.7 mg/m^3(8hr-TWA)

SECTION III - PHYSICAL DATA

BOILING POINT DEG F (DEG C): 234 DEG F (112 DEG C)

VAPOR PRESSURE (mm Hg): 20 mm Hg @ 20 DEG C

VAPOR DENSITY (AIR=1): 5.7

SOLUBILITY IN WATER (g/100 g water): 0.18 @ 20 DEG C. Soluble in organic solvents, lipids, organophosphorus compounds, mustards, phosgene, diphosgene, and Cl_2

SPECIFIC GRAVITY (H_2O=1): 1.7 @ 25 DEG C

FREEZING POINT: -83 DEG F (-64 DEG C)

LIQUID DENSITY (g/cc): 1.66

PERCENTAGE VOLATILE BY VOLUME: 165,000 mg/m^3 @ 20 DEG C

APPEARANCE AND ODOR: Colorless, oily liquid with a sharp, penetrating odor that causes tears.

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT (METHOD USED): Negligible fire hazard when exposed to heat or flame.

EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, water spray or regular foam. For larger fires, use water spray, fog or regular foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear chemical protective suit with self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. Move container from fire area if you can do so without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

WARNING: Extinguish with agents suitable for type of surrounding fire. Use flooding amounts of water and fog, avoid breathing poisonout vapors; keep upwind. Consider evacuation of downwind area if material is leaking.

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMIT (AEL): 0.7 mg/m^3

EFFECTS OF OVEREXPOSURE:

Short-term exposure: Chloropicrin causes eye irritation and tearing. It also causes cough, nausea, and vomiting, and severe irritation of the skin. Breathing chloropicrin vapors may also cause delayed severe breathing difficulties and which may cause death. Additional effects may include bluish color of skin, lips and fingernails.

Long-term exposure: Overexposure to chloropicrin may cause increased susceptibility to future overexposure. In addition to effects from short term exposure, redness and swelling of the skin and eyes and heart and lung damage may occur.

Median doses of PS in man are:

LCt50 = 2,000 mg-min/m^3

LOCALLY, PS affects both the eyes and the skin. The liquid irritates and burns the skin and causes severe burns of the eyes. Concentrations of 0.3 to 0.37 ppm result in painful eye irritation in 3 to 30 seconds. Short contacts with the skin can cause second and third degree burns.

SYSTEMIC ACTIONS occur primarily through inhalation and ingestion. Inhalation causes nausea, eye watering, vomiting, bronchitis, and pulmonary edema (the result of a lethal exposure of 119 ppm for 30 minutes). Ingestion causes severe irritation of mouth and stomach.

CHRONIC EXPOSURE to PS can result in increased susceptibility to future overexposure.

EMERGENCY AND FIRST AID PROCEDURES:

Get medical attention following all exposures to this compound

INHALATION. If a person breathes in large amounts of chloropicrin, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Maintain airway and blood pressure and administer oxygen if available. Keep the affected person warm and at rest. Treat symptomatically and supportively. Get medical attention as soon as possible.

EYE CONTACT. If liquid chloropicrin or high concentrations of chloropicrin vapor get into the eyes, wash eyes immediately with copious quantities of water for at least 15 minutes, lifting the lower and upper lids occasionally. Continue irrigating with normal saline until the pH has returned to normal (30-60 minutes). Cover with sterile bandages. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

SKIN CONTACT. If liquid chloropicrin gets on the skin, immediately wash the skin using soap or mild detergent and large amounts of water until no evidence of chemical remains (15-20 minutes). If liquid chloropicrin soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. In case of chemical burns, cover area with sterile, dry dressing, bandage securely, but not too tightly. If irritation persists after washing, get medical attention.

INGESTION. Remove by gastric lavage or emesis using activated charcoal. Gastric lavage or emesis should not be performed on an unconscious person. Treatment should be administered by qualified medical personnel. Get medical attention immediately.

SECTION VI - REACTIVITY DATA

STABILITY: Unstable liquid that decomposes under the influence of light. High temperatures or severe shock (particularly in containers larget than 30 gallons) also contribute to instability.

INCOMPATIBILITY: Contact with strong oxidizers may cause fires or explosions.

Aniline: violent reaction

Bromo-2-propyne: explosive, shock and heat sensitive

Sodium Hydroxide: reacts violently

Sodium Methoxide: below 50 DEG C, nitro compound will accumulate and cause a violent and dangerous exothermic reaction

Strong Oxidizers: possible violent reaction

HAZARDOUS DECOMPOSITION: Toxic gases and vapors (oxides of nitrogen, phosgene, nitrosyl chloride, chlorine, and carbon monoxide) may be released when chloropicrin decomposes. Decomposition occurs at temperatures above 400 DEG C.

HAZARDOUS POLYMERIZATION: Has not been reported to occur under normal temperatures and pressures.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Do not touch spilled material. Stop leak if you can do so without risk. Use water spray to reduce vapors. For small spills, take up with sand or other absorbent material and place into containers for later disposa. For small dry spills, place material into clean dry containers with clean shovel and cover. Move containers from spill area. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard area and deny entry. Ventilate closed spaces before entering.

WASTE DISPOSAL METHOD: Chloropicrin may be disposed of by absorbing in vermiculite, dry sand, earth, or a similar material and disposing in sealed containers in a secured sanitary landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

Concentration ppm	Respiratory Protection/Ensemble Required
2.5 ppm or less	Any supplied air respirator operated in a continuous flow mode. Any powered air surviving respirator with organic vapor cartridge(s).
2.5 to 4 ppm	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge. A gas mask with a chin-style or a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 4 ppm or entry & escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode.

VENTILATION:

Local Exhaust. Provide local exhaust or process enclosure ventilation to meet published exposure limits.

PROTECTIVE GLOVES: MANDATORY. Rubber

EYE PROTECTION: Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance.

OTHER PROTECTIVE EQUIPMENT: Impervious clothing should be worn, as well as any other appropriate protective clothing necessary to prevent any possibility of skin contact with liquid chloropicrin.

MONITORING: Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure leve. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:
Observe all federal, state and local regulations when storing or disposing of this substance. For assistance, contact the district director of the environmental protection agency.

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a well-ventilated area. Where there is any possibility that employees' eyes may be exposed to liquid chloropicrin, an eye-wash fountain should be provided within the immediate work area for emergency use. Where there is any possibility of exposure of an employee's body to liquid PS, facilities for quick drenching of the body should be provided within the immediate work area for emergency use. Eating and smoking should not be permitted in areas where liquid chloropicrin is handled, processed, or stored. Employees who handle liquid chloropicrin should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

SECTION X - TRANSPORTATION DATA

FORBIDDEN FOR TRANSPORT OTHER THAN VIA MILITARY (TECHNICAL ESCORT UNIT)

TRANSPORT AS PER 49 CFR 172

PROPER SHIPPING NAME: Chloropicrin UN 1580

DOT HAZARD CLASS: 6.1-Poisonous Materials Packing Group I

DOT LABEL: Poison

REVISED: January 1993

SIGMA-ALDRICH CORPORATION
1001 WEST SAINT PAUL AVE.
MILWAUKEE, WI 53233

Emergency Telephone #s:
ERDEC Safety Office
410-671-4411 0700-1700
EST After normal duty
hours: 410-278-5201
Ask for ERDEC Staff
Duty Officer

MATERIAL SAFETY DATA SHEET

SECTION I - GENERAL INFORMATION

MANUFACTURER'S NAME: Sigma-Aldrich Corporation

MANUFACTURER'S ADDRESS:
SIGMA-ALDRICH CORPORATION
1001 WEST SAINT PAUL AVE
MILWAUKEE, WI 53233

CAS REGISTRY NUMBER: 75-44-5

CHEMICAL NAME AND SYNONYMS:

Carbon dichloride oxide
Carbone (Oxychlorure DE) (French)
Carbonic Chloride
Carbonio (Ossicloruro DI) or Fosgene (Italian)
Carbon Oxychloride
Carbonylchloride or Phosgen (German)
Carbonyl Chloride
Carbonyl Chloride (DOT, OSHA)
Carbonyl Dichloride
Chloroformyl Chloride
Fosgeen or Koolstofoxychloride (Dutch)
Fosgen (Polish)

TRADE NAME AND SYNONYMS:

Phosgene
CG .

BIOLOGICAL TYPE COMPOUND: Lethal Agent

FORMULA/CHEMICAL STRUCTURE:

CCl_2O

```
Cl
 \
  C = O
 /
Cl
```

SECTION II - COMPOSITION

INGREDIENTS NAME	FORMULA	PERCENTAGE BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
CG	CCl_2O	99+	0.8 mg/m^3 (8 hr-TWA)

SECTION III - PHYSICAL DATA

BOILING POINT DEG F (DEG C): 45.7 DEG F (7.6 DEG C)

VAPOR PRESSURE (mm Hg): 1180 mm Hg @ 20 DEG C (1400 mm Hg @ 25 DEG C)

VAPOR DENSITY (AIR=1): 3.4

SOLUBILITY IN WATER: (g/100 g solvent @ 25 DEG C)

a. Water (distilled): very slight, with decomposition
b. Other: very soluble with almost all organic solvents, i.e., benzene, toluene. Unstable in some.
c. Best solvent: organic solvents

FREEZING POINT: 128 DEG C

LIQUID DENSITY (g/cc): 1.370 @ 20 DEG C

PERCENTAGE VOLATILE BY VOLUME: 4.3×10^6 mg/m^3 @ 7.6 DEG C
2.2×10^6 mg/m^3 @ -10 DEG C
5.28×10^5 mg/m^3 @ -40 DEG C

APPEARANCE AND ODOR: Colorless gas at room temperature. Odor of new-mown hay, grass, or green corn.

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT (METHOD USED): Does not flash

EXTINGUISHING MEDIA: Use water spray or fog nozzle to keep cylinder cool. Move cylinder away from fire if there is not risk.

SPECIAL FIRE FIGHTING PROCEDURES: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Protective clothing and a self-contained breathing apparatus should be worn to prevent contact with skin and eyes.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS: Contents under pressure. Container explosion may occur under fire conditions. Toxic fumes are emitted under fire conditions.

DANGER: POISONOUS AND CORROSIVE NONFLAMMABLE LIQUID AND GAS UNDER PRESSURE.

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMIT (AEL): The AEL for CG is 0.8 mg/m^3.

EFFECTS OF OVEREXPOSURE: CG is a burning agent that is extremely destructive to the tissue of the mucous membranes and upper respiratory tract, eyes and skin. Inhalation may be fatal as a result of spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Median doses of CG in man are:

ICt_{50} = 1600 mg-min/m^3 at 70 - 80 DEG F (humid environment)
LCt_{50} = 3200 mg-min/m^3 (Ct does not significantly change with time since the effects are cumulative)

Locally, CG causes mild irritation to the eyes

SYSTEMIC ACTIONS occur primarily through inhalation. Phosgene is a lung irritant. The characteristic feature of phosgene poisoning is massive pulmonary edema. The edema results from the passage of fluid into the alveoli from capillaries whose permeability has been affected by the corrosive action of the compound. Hemoconcentration results from loss of plasma into the alveoli. The edema interferes with the interchange of oxygen and carbon dioxide and the capillary blood. As the edema progresses, discomfort, apprehension, and dyspnea increase, and frothy, often blood-tinged sputum is raised. Rales and rhonchi are audible in the chest. Death results from anoxemia and may occur in less than 5 hours.

During and immediately after exposure, symptoms include coughing, choking, a feeling of tightness in the chest, nausea, and occasionally headache and lacrimation. Some patients with severe cough fail to develop serious lung injury, while others with no signs of early respiratory tract irritation incur fatal pulmonary edema. Following the above discomfort, there may be a delay in which the patient has few symptoms, not even abnormal chest signs.

CHRONIC EXPOSURE: Five industrial workers who had been chronically exposed to low concentrations of CG exhibited disturbances in lung function. All of the patients developed the following signs and symptoms over a period of several months with varying degrees of severity: cough, shortness of breath on exertion, and pain or tightness in the chest. Two of the patients also expectorated small amounts of glairy, mucoid sputum. Residual pulmonary deficit may be expected from chronic exposure to CG.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION. The protective mask should be put on immediately upon detection of the odor of phosgene (like green corn or grass), irritation of the eyes, or change in the taste of a cigarette (smoking may become tasteless or offensive in taste). The individual should hold his breath while masking.

If some phosgene has been inhaled, normal combat duties should be continued unless there is difficulty in breathing, nausea, and vomiting, or more than the usual shortness of breath on exertion.

If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

EYE CONTACT. Immediately flush eyes with copious amounts of water for at least 15 minutes while removing contamintaed clothing and shoes. Assure adequate flushing of the eyes by separating the eyelids with fingers.

SKIN CONTACT. Immediately flush skin with copious amounts of water for at least 15 minutes while removing contaminated clothing and shoes. Discard contaminated clothing and shoes.

INGESTION. Wash out mouth with water, provided the person is conscious. Call a physician immediately.

SECTION VI - REACTIVITY DATA

STABILITY: Stable in steel containers if CG is dry. Decomposition temperature is 800 DEG C. No action on metals when CG is dry; acidic and corrosive when moist.

INCOMPATIBILITY: Rapid hydrolysis to hydrochloric acid and carbon dioxide under acidic conditions. Under basic conditions, hydrolysis products are sodium chloride and sodium carbonate. Rain destroys effectiveness. Heavy vegetation, jungle, and forests cause considerable loss by hydrolysis on leafy surfaces. Incompatible materials include water, amines, ammonia, alcohols, sodium, and potassium.

HAZARDOUS DECOMPOSITION: Toxic fumes of carbon monoxide, carbon dioxide, and hydrogen chloride gas.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Evacuate the area and keep personnel upwind. Wear full protective equipment such as a butyl rubber chemical-proof air suit, with breathing air supplied. If no risk exists, then shut off leak. Ventilate area and wash spill site after material pickup is complete.

RECOMMENDED FIELD PROCEDURES: Caution: no-return cylinder. Do not reuse. Empty cylinders will contain hazardous residue. Follow proper disposal techniques, and observe all federal, state, and local laws.

SECTION VIII - SPECIAL PROTECTION INFORMATION

VENTILATION: Use only in a chemical fume hood. NIOSH/MSHA-Approved respirator in nonventilated areas and/or for exposure above the ACGIH TLV.

PROTECTIVE GLOVES: MANDATORY. Rubber gloves

EYE PROTECTION: Chemical safety goggles

MONITORING: Can be detected using M18A2 and M19 Kits, and M8 Alarm

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:
Phosgene is a compressed gas; cylinder temperature should not exceed 125 DEF F (52 DEG C). It should be used with equipment rated for cylinder pressure of compatible construction material. Be sure that the cylinder is properly secured when in use or stored.

SECTION X - TRANSPORTATION DATA

FORBIDDEN FOR TRANSPORT OTHER THAN VIA MILITARY (TECHNICAL ESCORT UNIT)

TRANSPORT AS PER 49 CFR 172

DOT HAZARD CLASS: Poison A

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Driver shall be given full and complete information regarding shipment and conditions in case of emergency.

ATTACHMENT A-6
Draft Memoranda of Agreement

327 215

Scope of Work

Ambulance/EMT/Paramedic Service in Support of the Engineering Evaluation/Cost Analysis Defense Depot, Memphis Tennessee

The work required under this Scope of Work (SOW) falls under the Base Realignment and Closure (BRAC) Program and is in support of the Chemical Warfare Materiel (CWM) Engineering Evaluation/Cost Analysis (EE/CA) being conducted at the Defense Depot in Memphis, Tennessee. CWM and Ordnance and Explosives (OE) are suspected to exist on this property formerly owned by the Department of the Army and is currently owned by the Department of Defense.

The EE/CA field work will consist of a maximum of three (3) weeks and includes the installation of six (6) monitoring wells at Dunn Field. The field work is scheduled for 3 weeks during July/August 1998. The contractor will not exceed 150 hours of field support. The wells will be located a safe distance from areas suspected of containing buried CWM and OE. Chemicals suspected at Dunn Field include: mustard, lewisite, chloropicrin, phosgene and chloroform. Attachment A contains an MSDS for each of the chemical agents listed above. Several other industrial chemicals are suspected at Dunn Field. See attachment B for a listing of these chemicals.

RESPONSIBILITIES.

1. The services required by the ambulance/EMT/Paramedic Service include:

a. To have on-site during all site activities, a state or National Registry of Emergency Medical Technician-certified IV EMT and paramedic who have been trained in chemical warfare agent casualty care and are currently certified in the 40 hour HAZWOPER.

b. To have on-site during all site activities, a DOT-approved ambulance ready to transport decontaminated casualties to the Regional Medical Center.

c. To provide the required medical care after receiving the casualty at the decontamination line and to transport the casualty to the Regional Medical Center after the person has been stabilized.

327 216

d. To help with the heat stress monitoring, as requested.

e. To procure and have on-site the medical supplies necessary for the treatment of the chemical agent casualties and to ensure that any such medications accompany the patient to the hospital. The following list contains the minimum requirements. Additional supplies normally found on an ambulance should also be on-site.

1. Sodium nitrite injection, USP 300 mg/ 10 ml (4 ea)
2. Sodium thiosulfate injection, USP 12.5 gr, 50 ml (4 ea)
3. British anti-lewisite injection, 10% in oil (2 ea)
4. Calcium gluconate 10% (mg/10 ml) injection (subcutaneous), USP
5. Oropharynegeal airways (6 ea)
6. Portable oxygen cylinder (2 ea)
7. Non-rebreather oxygen masks and tubing (4 ea)
8. Sterile water (4 bottles ea)
9. Suction apparatus, oropharngeal with catheters (1 ea)
10. Pocket masks (3 ea)
11. Bag valve masks (2 each-no pop-off valves)
12. Resuscitator, hand powered, intermittent positive pressure (1 ea)
13. IV catheters, 16, 18 and 20 gauge (5 ea)
14. IV solution (ringer's lactate, D5W) (3 ea)
15. Semi-rigid cervical collars (3 ea)
16. Backboards with head immobilizer
17. Laryngoscope (2 ea)
18. Endotracheal tubes (7 mm and 8 mm) (3 ea)
19. Albuterol inhalers (5)
20. Portable monitor/defibrillator
21. Epinephrine injection (1/1000, 1/10,000)

f. To designate EMT/paramedics to attend the required medical training for the treatment and CWM casualties.

2. The Huntsville Corps of Engineers will provide the following support:

a. To provide the EMTs/paramedics with a list of chemicals suspected to be on-site to which the workers could be exposed while conducting activities at Dunn Field, along with a description of the potential health effects.

327 217

b. In the event of a chemical warfare materiel exposure to ensure that any potentially exposed casualty is decontaminated using approved Department of Army decontamination solutions and procedures.

c. To arrange for the provision of initial medical training to the ambulance personnel involved with the initial transfer of CWM causalities.

d. To provide an opportunity for the ambulance personnel to participate in a CWM emergency exercise.

e. To take responsibility and accountability for any medical equipment which becomes contaminated with CWM until the medical equipment is destroyed by authorized methods or released by competent authority.

327 218

MEMORANDUM OF AGREEMENT
BETWEEN
U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
AND
SHELBY COUNTY HEALTHCARE CORPORATION
d/b/a
THE REGIONAL MEDICAL CENTER AT MEMPHIS

SUBJECT: Treatment of Chemical Warfare Materiel Casualties at The Regional Medical Center at Memphis

1. PURPOSE: The purpose of this Memorandum of Agreement (MOA) is to clearly establish the responsibilities and the organizational relationship between the U.S. Army Engineering and Support Center, Huntsville (USAESCH) and Shelby County Healthcare Corporation d/b/a The Regional Medical Center at Memphis. This MOA relates to the treatment at The Regional Medical Center at Memphis of workers actually or potentially exposed to chemical warfare materiel (CWM) at Dunn Field, Memphis Depot in Memphis, Tennessee. Workers include all Department of the Army and contract employees working on-site.

2. REFERENCES:

2.1 Department of Army Pamphlet (DA PAM) 50-6, 1 February 1995, Chemical Accident or Incident Response and Assistance Operations.

2.2 Memorandum, SFIL-PMS, 23 November 1992, subject: Medical Support Requirements for Non-Stockpile Chemical Materiel Activities.

3. RESPONSIBILITIES:

3.1 U.S. Engineering and Support Center, Huntsville (USAESCH) hereby agrees to the following provisions:

3.1.1 To provide Regional Medical Center with a list of chemical warfare materiel to which workers could be exposed while conducting activities at Memphis Depot, Tennessee along with a description of potential health effects.

3.1.2 In the event of a potential chemical warfare materiel exposure, to ensure that any potentially exposed casualties are decontaminated using approved Department of the Army decontamination solutions and procedures.

3.1.3 To arrange for the provision of initial and annual refresher (as necessary) medical training for the treatment of chemical warfare materiel casualties to those personnel of The Regional Medical Center who may be involved with the treatment and management of Chemical Warfare Materiel casualties. The training will include instruction and guidance in the handling and/or procedures necessary to properly treat exposed workers.

3.1.4 To provide an opportunity for Regional Medical Center personnel to participate in chemical warfare materiel emergency exercises including the table top exercise and pre-operational survey.

3.1.5 To have an on-site, DOT-approved ambulance ready to transport decontaminated casualties to The Regional Medical Center.

3.1.6 To take full responsibility and accountability for any medical equipment which becomes contaminated with chemical warfare materiel until the medical equipment is destroyed by authorized methods or until released by competent authority. In all respects and at all times, this function shall remain the sole duty of USAESCH.

3.2 The Regional Medical Center hereby agree to the following provisions:

3.2.1 To have available on duty at The Regional Medical Center, during mutually agreed upon times, staff members designated by the hospital administrator, that have been trained in chemical warfare materiel casualty care.

4. RESOURCES.

4.1 No additional manpower spaces will be required from the other party. Each party will execute its responsibilities from the resources allocated through normal allocation procedures.

4.2 USAESCH agrees to reimburse The Regional Medical Center, at usual and customary rates, for all charges incurred by USAESCH employees and/or agents during their treatment.

4.3 USAESCH agrees to reimburse The Regional Medical Center for all costs incurred in providing nurses the initial and annual (if necessary) medical training and the table top and pre-operational survey. Said costs shall include, but not necessarily be limited to, the following: salary and/or hourly wage for the nurses attending the required medical training; salary and/or hourly wages, even if at one and one-half times the normal hourly rate of nurses substituting at The Regional Medical Center for those nurses participating in the required medical training.

5. DURATION AND REVIEW.

This Memorandum of Agreement is effective for planning and coordination action on the date of later signing.

The parties to this MOA will meet at the request of either party to review the provisions of this agreement. Any revisions, additions, deletions, or changes will be made in writing and signed by the signatories or their designated representatives.

This MOA will remain in effect until superseded or terminated by written mutual agreement. Planning meetings will be conducted annually, or more frequently if necessary, to re-coordinate the provisions of the memorandum. Either party wishing to terminate this MOA shall submit a written notification with sufficient notice to prevent unreasonable disruption to the project, but in no event shall the notice be less than 60 days.

3.3.2 To provide required medical care after receiving decontaminated CWM casualties at the emergency room or other location designated by The Regional Medical Center.

3.2.3 To designate at least, but not necessarily more than, four (4) nurses who shall attend required medical training on the treatment and management of chemical warfare materiel casualties and to make those individuals available for participation in the annual refresher training.

3.2.4 To have available at The Regional Medical Center the following emergency treatment medical supplies for treatment of any warfare agency casualty:

3.2.2.1 Sodium Nitrate injection, USP 300mg/10ml (4 ea)

3.2.2.2 Sodium Thiosulfate injection, USP 12.5 gr, 50 ml (4 ea)

3.2.2.3 British Anti-Lewisite (BAL) injection, 10 percent in oil (2 ea)

3.2.2.4 Calcium Gluconate 10% (mg/10ml) injection (subcutaneous)

3.2.4 Upon consent of the patient or patient's authorized representative, to allow authorized representatives of the Army or contractor full access to any health records or documents initiated during the evaluation or treatment of worker(s) potentially exposed to chemical warfare materiel. Provided, however, this provision will impose no obligation on The Regional Medical Center to release any information in violation of any State or Federal law, rule, or regulation.

3.2.5 To notify a designated representative of the U.S. Army Corps of Engineers whenever an Army or contractor employee has been exposed to chemical warfare materiel. Provided, however, this provision will impose no obligation on The Regional Medical Center to release any information in violation of any State or Federal law, rule, or regulation.

327 222

MEMORANDUM OF AGREEMENT
BETWEEN
U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
AND
UT MEDICAL GROUP, INC.

SUBJECT: Off-Site Treatment of Chemical Warfare Materiels Casualties at Memphis Depot Memphis, Tennessee

1. PURPOSE: The purpose of this Memorandum of Agreement (MOA) is to clearly establish the responsibilities and the organizational relationship between the U.S. Army Engineering and Support Center, Huntsville (USAESCH) and the UT Medical Group, Inc. (UTMG). This MOA relates to the off-site treatment of workers potentially exposed to chemical warfare materiel at the Memphis Depot, Tennessee. Workers include all Department of the Army and contract employees working on site.

2. REFERENCES:

2.1 Department of Army Pamphlet (DA PAM) 50-6, 1 February 1995, Chemical Accident or Incident Response and Assistance Operations.

2.2 Memorandum, SFIL-PMS, 23 November 1992, subject: Medical Support Requirements for Non-Stockpile Chemical Materiel Activities.

3. RESPONSIBILITIES:

3.1 U.S. Engineering and Support Center, Huntsville (USAESCH) hereby agrees to the following provisions:

3.1.1 To provide UTMG with a list of chemical warfare materiel to which workers could be exposed while conducting activities at Memphis Depot, Tennessee along with a description of potential health effects.

3.1.2 In the event of a potential chemical warfare materiel exposure, to ensure that any potentially exposed casualties are decontaminated using approved Department of the Army decontamination solutions and procedures.

3.1.3 To arrange for the provision of initial and annual (as required) refresher medical training for the treatment of chemical warfare materiel casualties to those UTMG personnel who may be involved with the treatment and management of Chemical Warfare Materiel casualties.

3.1.4 To provide an opportunity for UTMG personnel to participate in chemical warfare materiel emergency exercises including the table top exercise and pre-operational survey.

3.1.5 To have an on-site, DOT-approved ambulance ready to transport decontaminated casualties to the Regional Medical Center.

3.1.6 To take responsibility and accountability for any medical equipment which becomes contaminated with chemical warfare materiel until the medical equipment is destroyed by authorized methods or until released by competent authority.

3.2 UTMG hereby agrees to the following provisions:

3.2.1 To have available on duty at the Regional Medical Center, during mutually agreed-upon times, staff members designated by the hospital administrator and Chief Medical Officer of UTMG, that have been trained in chemical warfare materiel casualty care.

3.3.2 To provide required medical care after receiving decontaminated CWM casualties at the emergency room or other location designated by the Regional Medical Center.

3.2.3 To designate UTMG physicians to attend required medical training on the treatment and management of chemical warfare materiel casualties and to make those individuals available for participation in the annual refresher training, such training to coincide with stages of operation at Dunn Field, Memphis Depot.

3.2.4 Upon consent of the patient or patient's authorized representative, to allow authorized representatives of the Army or contractor full access to any health records or documents initiated during the evaluation or treatment of worker(s) potentially exposed to chemical warfare materiel. This provision, however, will impose no obligation on UTMG to release any information in violation of any applicable laws, regulations, policies or contracts.

3.2.5 To notify a designated representative of the U.S. Army Corps of Engineers whenever an Army or contractor employee has been exposed to chemical warfare materiel. This provision, however, will impose no obligation on UTMG to release any information in violation of any applicable laws, regulations, policies or contracts.

4. RESOURCES.

4.1 No additional manpower spaces will be required from the other party. Each party will execute its responsibilities from the resources allocated through normal allocation procedures.

4.2 Reasonablé costs associated with physician training will be paid by USAESCH to UTMG according to the attached Schedule A which is incorporated herein and made a part of this agreement.

4.3 In the event a casualty patient requires medical or surgical care by UTMG physicians, the usual and customary charges will be made for those services. The patient's employer will assure reimbursement to UTMG for these charges. UTMG and it's physicians will aid in executing any reasonable required insurance documents.

5. DURATION AND REVIEW.

This Memorandum of Agreement is effective for planning and coordination action on the date of later signing.

The parties to this MOA will meet at the request of either party to review the provisions of this agreement. Any revisions, additions, deletions, or changes will be made in writing and will only be effective if signed by the signatories or their designated representatives.

This MOA will remain in effect until superseded or terminated by written mutual agreement. Planning meetings will be conducted annually, or more frequently if necessary, to re-coordinate the provisions of the memorandum. Either party wishing to terminate this MOA shall submit a written notification with sufficient notice to prevent unreasonable disruption to the project, but in no event shall the notice be given in less than 60 days.

Walter J. Cunningham — Date
Colonel, Corps of Engineers
Commanding

Steve Burkett — Date
President and CEO
UT Medical Group, Inc.

James W. Pate — Date
Chief Medical Officer
UT Medical Group, Inc.

327 226

Walter J. Cunningham
Colonel, Corps of Engineers
Commanding Officer

Date

Shelby County Healthcare Corporation

Date

327 227

Schedule A
Schedule of Costs Associated With Required Training of the UTMG Physicians
for
The Off-Site Treatment of Chemical Warfare Materiel Casualties at Memphis Depot
Memphis, Tennessee

Training. Will be carried out over 3 days in facilities of UTMG in July 1998 and annually thereafter, as needed.

o	Facility costs by UTMG (Classroom, conference room, projectors, etc)	$ 0
o	Emergency Department Physicians (3 @ $750/ day)	$2,250
o	Burn Center Surgeons (2 @ $880/ day)	$1,760
o	Critical Care Specialists (3 @ $1,000/ day)	$3,000
o	Trauma Center Coordinating Surgeon (2 @ $1,000/day)	$2,000
o	Hyperbaric Pressure Team (One diver-technician @ $450 & one nurse @ $175)	$ 625
	TOTAL	$9,635

ATTACHMENT A-7
TEU Maximum Credible Event (MCE) and No Effects Distance

TASKER CM-072

MCE and Associated Nose for DDMT

The MCE for the soil sampling operation is:

a. Based on computations generated by our Safety Office (MAJ Porter)

1. 7.1 fluid ounces of mustard (HD) with the following parameters used to determine the downwind hazard distance.

The Downwind Hazard Area is determined using the D2PC Model with the following parameters:

a: Location used is Pine Bluff Arsenal (PBA)
b. Season used is Spring
c. Munition Type is NON
d. Agent is HD (Mustard)
e. Release is Evaporative (EVP)
f. Stability is F (Stable)
g. WS/MPH (windspeed) 1 Meter per second
h. Source is 7.1 fluid ounces
i. Temperature used was from 50 degrees F to 85 degrees F
j. Surface Code used is GRA for gravel/loose earth
k. Evaporative time used was from 15 to 30 minutes (this time is approximated based on using the RTAP with it's 10-12 minute response time and the probability of running a corroborating sample)

The results were 0 meters to a 1% lethality distance
0 meters to No deaths
0 to 14 meters as a No Effects Distance

Based on this the evacuation distance during sampling operations is 15 meters so long as the following operational controls are in place:

- Temperature must be between 50 and 80 degrees farenheit during sampling operations.
- Real time monitoring during the sampling activity must be continuous and affirmation tests of positive indications performed in an expeditious manner.
- Contractor develops plans for Asafing the hole@ during soil sampling operations, if it becomes necessary. (Safing the hole will entail some means of temporarily sealing the hole and establishing continuous downwind air monitoring, should the RTAP or minicam give a positive indication of agent contamination.

TAB

Appendix B

APPENDIX B
GUIDE FOR UXO AVOIDANCE

CMS Environmental, Inc.
A Member of the DaimlerBenz Group

U.S. Army Engineering and Support Center, Huntsville
SAFETY CONCEPTS AND BASIC CONSIDERATIONS FOR
UNEXPLODED ORDNANCE (UXO) OPERATIONS

1. Introduction. There is no "safe" procedure for dealing with UXO, merely procedures which are considered least dangerous. However, maximum safety in any UXO operation can be achieved through adherence to applicable safety precautions, a planned approach and intensive supervision. Only those personnel absolutely essential to the operation shall be allowed in the restricted/exclusion area during UXO operations (DoD 6055.9-STD). Safety must become a firmly established habit when working with UXO. Safety is the leading edge of quality.

2. References. The following documents form a part of this document to the extent referenced.

ATFP 5400.7	Alcohol Tobacco and Firearms Explosives Laws and Regulations
27 CFR Part 55	Commerce in Explosives
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
49 CFR 100-199	Transportation
DoD 6055.9-STD	DoD Ammunition and Explosives Safety Standards
DA Pam 385-64	Ammunition and Explosives Safety Standards
ETL 385-1-2	Generic Scope of Work for Ordnance Avoidance Activities
TM 9-1300-200	Ammunition General
TM 9-1300-214	Military Explosives
TM 9-1375-213-12	Operator's and Organization Maintenance Manual (Including Repair Parts and Special Tools List); Demolition Materials

3. Definitions

a. Unexploded Ordnance (UXO). An item of ordnance which has failed to function as designed, or has been abandoned or discarded, and is still capable of functioning and causing injury to personnel or damage to material.

b. UXO Procedures. UXO procedures include but are not limited to the following actions:

(1) Gaining access to (manual excavation) and identifying subsurface anomalies, and assessing condition of

buried UXO.

(2) Identifying and assessing condition of surface UXO.

(3) Recovery and final disposal of all UXO.

c. UXO Related procedures: UXO related procedures include but are not limited to the following:

(1) Location and marking of subsurface anomalies.

(2) Location and marking of suspected surface UXO.

(3) Transportation and storage of recovered UXO.

(4) Utilizing Earth Moving Machinery (EMM) to excavate soil to no closer than approximately 12 inches of a subsurface anomaly.

d. UXO Qualified Personnel: UXO qualified personnel are US citizens who have graduated from the US Army Bomb Disposal School, Aberdeen, MD, or the US Naval Explosive Ordnance Disposal (EOD) School, Indian Head, MD. Graduates of the EOD assistant Course, Redstone Arsenal, AL, or Elgin AFB, FL with more than three years combined active duty military EOD and contractor UXO experience shall also be UXO qualified.

4. General Safety Concerns

a. UXO operations shall not be conducted until a complete plan for the operation involved is prepared and approved. Plans shall be based upon limiting exposure to a minimum number of personnel, for a minimum time, to the minimum amount of UXO, consistent with safe and efficient operations.

b. Only UXO qualified personnel shall be involved in UXO procedures. Non-UXO qualified personnel may be utilized to perform UXO related procedures when supervised by UXO qualified personnel. All personnel engaged in operations shall be thoroughly trained in explosive safety and be capable of recognizing hazardous explosive exposures.

c. The use of electroexplosive devices (EED) susceptible to electromagnetic radiation (EMR) devices in the radio frequency (RF) range, that is, radio, radar, and television transmitters, has become almost universal.

d. Some ordnance is particularly susceptible to EMR (RF) emission.. A knowledge of ordnance that is normally unsafe in the presence of EMR (RF) is important so preventive steps can be taken if the ordnance is encountered in a suspected EMR (RF) field.

(2) The presence of antennas, communication and RADAR devices should be NOTED on initial site visits and/or preliminary assessments.

(3) When potential EMR hazards exist, the site shall be electronically surveyed for EMR/RF emissions and the appropriate actions will be taken. Minimum safe distances from EMR/RF sources are listed in Tables 2-2, 2-3, and 2-4 of TM 9-1375-213-12.

f. Do not wear outer or undergarments made of materials which have high static generating characteristics when working on UXOs. Materials of 100 percent polyester, nylon, silk, or wool are highly static-producing. Any person handling a UXO suspected of containing EEDs will ground himself/herself prior to touching the UXO. Refer to DA Pam 385-64 for more information regarding non-static producing attire.

5. UXO Safety Precautions for Site Characterization

a. Make every effort to identify the UXO. Visually examine the item for markings and other identifying features such as shape, size, and external fittings. However, do not move the item to inspect it. If an unknown UXO is encountered, the US Army Engineering and Support Center, Huntsville (USAESCH) representative will be notified.

b. Foreign UXO were returned to the United States for exploitation and disposal. When a records search indicates the possibility of foreign UXO being on a site, appropriate safety precautions and procedures will be incorporated into UXO operation plans.

c. Any time a suspected chemical munition is encountered, all personnel will withdraw up wind from the munition. A two person UXO team, located upwind, shall secure the munition until relieved by the Technical Escort Unit (TEU) or Explosive Ordnance Disposal (EOD) personnel.

d. Ordnance items which penetrate the earth to a depth where the force of the explosion is not enough to rupture the earth's surface forms an underground cavity called a camouflet. Camouflets will be filled with the end product of the explosion, carbon monoxide gas. Camouflet detection and precautions must be considered if a records search indicates the site was used as an impact area.

e. Avoid inhalation of, and skin contact with, smoke, fumes, and vapors of explosives and related hazardous materials.

f. Consider UXO which has been exposed to fire and detonation as extremely hazardous. Chemical and physical changes may have occurred to the contents which render it much more sensitive than it was in its original state.

g. Do not rely on the color coding of UXO for positive identification of contents. Munitions having incomplete, or improper color coding have been encountered.

h. Avoid the area forward of the nose of a munition until it can be ascertained the item does not contain a shaped charge. The explosive jet can be fatal at great distances forward of the longitudinal axis of the item. Assume any shaped charge munitions to contain a piezoelectric (PZ) fuzing system until the fuzing system is positively identified. A PZ fuze is extremely sensitive, can function at the slightest physical change, and may remain hazardous for an indefinite period of time.

I. Examine a projectile for the presence or absence of an unfired tracer. Also examine the item for the presence or absence of a rotating band and it's condition.

j. Approach an unfired rocket motor from the side. Ignition will create a missile hazard and hot exhaust.

(1) Do not expose rocket motors to any EMR source.

(2) If an unfired rocket motor must be transported, it shall be positioned in the direction which offers the least exposure to personnel in the event of an accidental ignition.

k. Consider an emplaced landmine armed until proven otherwise. It may not be possible to tell, or it may be intentionally rigged to deceive.

(1) Many training mines contain firing indicator charges capable of inflicting serious injury.

(2) Exercise care with wooden mines that have been buried for a long time. Because of soil conditions, the wood deteriorates and the slightest inadvertent pressure/movement may initiate the fuze.

l. Assume a practice UXO contains a live charge until it can be determined otherwise. Expended pyrotechnic/practice devices may contain red/white phosphorus residue. Due to incomplete combustion, phosphorous may be present and reignite spontaneously if subjected to friction or the crust is broken and the contents exposed to air."

m. Do not approach a smoking white phosphorus (WP) UXO. Burning WP may detonate the burster or dispersal explosive charge at any time.

n. If the positive identification of suspected explosive materials is required, procedures in Chapter 13, TM 9-1300-214, " Military Explosives" or other approved explosives analysis shall be used to identify the explosives.

6. Ordnance Avoidance for HTRW Activities

a. Investigative activities on potential ordnance contaminated sites will be accomplished using approved ordnance avoidance procedures.

b. HTRW ordnance avoidance procedures are detailed in Engineering Technical Letter 385-1-2. This ETL is available on the Internet, or through the Quality and Technology team at USAESCH.

7. Restricted/Exclusion Area Operations

a. On Ordnance and Explosives sites, the contractor's site safety personnel shall establish a restricted/exclusion area for each UXO team operating on the site. The purpose of the area is for the protection of the public and other personnel from the blast and fragmentation hazards of an accidental detonation. The area shall be establish based on the following minimum factors:

(1) Previous site use that caused the contamination: impact area, open burn/ open detonation, burial, etc..

(2) Project type: surface clearance, subsurface clearance, sifting operation, sampling, etc..

(3) Known ordnance contamination, distances to public exposure, terrain, etc..

b. When multiple UXO teams are operating on a site, the restricted/exclusion area and team separation distances shall never be less than 200 feet.

c. During the time frame that UXO operations are being accomplished, only personnel necessary for the UXO operation shall be within the restricted/exclusion area. When non-essential personnel enter the restricted/exclusion area, all UXO operations will cease.

(1) Plan for, provide, and know the measures to be taken in the event of an accident.

(2) Provide a designated emergency vehicle in the area in case of an accident or other emergency.

(3) Coordination with the appropriate airspace representative shall be conducted and the appropriate notification procedures arranged.

(4) When non-essential personnel must enter the restricted/exclusion area, the following must be accomplished: a) The individual must receive a safety briefing, b) be escorted by a UXO qualified individual; and c) All UXO operations must cease within the fragmentation radius of the largest item expected to be encountered within the area.

d. Before any movement of a UXO, the fuze condition must be ascertained. If the condition is questionable, consider the fuze to be armed. The fuze is considered the most hazardous component of a UXO, regardless of type or condition.

(1) In general, a projectile containing a Base Detonating (BD) fuze is to be considered armed if the projectile has been fired.

(2) Arming wires and pop out pins on unarmed fuzes should be secured by taping in place prior to movement.

(3) Do Not dismantle or strip any UXO.

(4) Do Not depress plungers, turn vanes, or rotate spindle, levers, setting rings, or other external fittings on UXO's. Such actions may arm, actuate, or function the UXO.

(5) Do Not subject mechanical time fuzes to any unnecessary movement.

(6) Do Not remove any fuzes from UXO's.

(7) Some ordnance items do not contain any positive safety features. Positively identify and review all safety precautions prior to handling any ordnance.

e. Personnel working within the Restricted area/Exclusion zone shall comply with the following:

(1) Do not conduct operations without an approved Site Specific Safety and Health Plan and an approved Work Plan.

(2) Do not smoke, except in authorized areas.

(3) Do not have fires for heating or cooking, except in authorized areas.

(4) Do not conduct explosive operations during electrical, sand, dust, or snow storms.

(5) Explosive operations will be conducted during daylight only.

(6) During magnetometer operations, UXO teams shall not wear safety shoes or other footwear which would cause the magnetometer to present a false indication.

f. Do not undertake the handling or disposal of liquid propellant fuels or oxidizers if not familiar with the characteristics of the material.

g. Civil War projectiles shall be treated as any other UXO.

h. If records search indicated WP munitions were fired or destroyed in the area, extra care shall be taken when uncovering a buried UXO, A buried WP munition may be damaged and when exposed to air, may start burning and detonate. An ample supply of water and mud shall be immediately available if excavation reveals a WP UXO. Appropriate protective equipment (leather gloves, face shield, and flame-retardant clothing) and first aid shall also be immediately available.

8. Storage

a. During Ordnance and Explosives projects, storage of explosives and UXO fall into two categories.

(1) On-DoD Installations.

(2) Off-DoD Installations.

b. On-DoD Installation Storage.

(1) The provisions of DoD 6055.9-STD shall be followed. Generally, an installation should have an explosive storage area that meets requirements in DoD 6055.9-STD. Permitting and compliance requirements for existing facilities are an installation responsibility. Compatibility of explosives found in Chapter 3, DoD 6055.9 -STD shall be complied with. UXO awaiting disposal shall not be stored with other explosives.

(2) If an installation does not have an existing storage facility, the provisions of paragraph c. below shall apply.

c. Off-DoD Installation Storage.

(1) Generally, the contractor is responsible for construction of a temporary explosive storage area that meets all local, state, ATF requirements, and as much of DoD 6055.9-STD that is practical to implement.

(2) When establishing an explosive storage area, the following requirements must be met.

(a) The area shall, if possible, meet the inhabited building and public traffic route distances specified in DoD 6055.9-STD. If the distances are less than required by DoD 6055.9-STD, then a proposed barricading and berm plan to protect the public from accidental detonation must be submitted and approved.

(b) Magazines must meet requirements of ATF Regulations, and each magazine must have an Net Explosive Weight established for the explosives to be stored.

© Each magazine must have lightning protection IAW Chapter 7, DoD 6055.9-STD.

(d) Magazines must meet intramagazine distances as defined in Chapter 9, DoD 6055.9-STD.

(e) A physical security survey shall be conducted to determine if fencing or guards are required. Generally, a fence around the magazines is needed, but the contractor is responsible to determine the degree of protection required to prevent the theft of explosives and UXO.

d. A fire plan for the storage area shall be prepared and coordination with the nearby fire department shall be conducted. Placarding of magazines shall be in accordance with local, state, and federal requirements.

9. Excavation Operations.

a. The usual method for uncovering buried UXO is to excavate by hand. Hand excavation is the most reliable method for uncovering UXO, but unless the UXO is very near the surface, hand excavation exposes more people to the hazard of detonation for a longer period of time than any other method. Hand excavation will be accomplished only by UXO qualified personnel.

b. Earth moving machinery (EMM) may be used to excavate buried UXO, if the UXO is estimated to be deeper than 12 inches. EMM shall not be used to excavate within 12 inches of an UXO. When excavation gets within approximately 12 inches of an UXO, hand excavation shall be used to uncover the UXO. EMM may be operated by non-UXO personnel, under the direct supervision of UXO personnel.

(1) If more than one EMM will be used on the same site, they will be separated by the same separation distances required for multiple teams on that site.

(2) During excavation operations, only those personnel absolutely necessary for the operation shall be within the restricted area/exclusion zone.

(3) Excavation and trenching shall comply with the provisions of 29 CFR 1926 subpart P.

10. Disposal Operations.

a. As a general rule, UXO will be detonated in place when the situation allows. All detonation-in-place operations shall be conducted by electrical means to assure maximum control of the site, except in situations where static electricity or EMR hazards are present. Non-electrical means can be used when the situation dictates.

(1) Do not allow one person to work alone in disposal operations. At least one person shall be available near the disposal site to give warning and assist in rescue activities in the event of an accident.

(2) Loose initiating explosives include lead azide, mercury fulminate, lead styphnate, and tetracene. These explosives manifest extreme sensitivity to friction, heat, and impact. Extra precautions may be required when handling these types of explosives. Keep initiating explosives in a water-wet condition at all times until ready for final preparation for detonation, the sensitivity of these explosives is greatly increased when dry.

(3) Only condition "Code A" or "Code C" explosive items shall be used as donor explosives for disposal operations.

(4) Exercise extreme care in handling and preparing high explosives for detonation. They are subject to detonation by heat, shock, and friction.

(5) Do not pack bomb fuze wells with explosives unless it can be positively confirmed that the fuze well does not contain any fuze components.

(6) Photo flash bombs must be handled with the same care as black powder filled munitions.

(7) WP UXO shall not be detonated into the ground. The UXO shall be counter-charged on the bottom center line when possible.

b. The following safety rules will be adhered to at all times:

(1) Carry blasting caps in approved containers and keep them out of the direct rays of the sun, and located at least 25 feet from other explosives, until they are needed for priming.

(2) Do not handle, use, or remain near explosives during the approach or progress of an electrical storm. All persons should retire to a place of safety.

(3) Do not use explosives or accessory equipment that is obviously deteriorated or damaged. They may cause a premature detonation or fail completely.

(4) Always point the explosive end of a blasting cap, detonators, and explosive devices away from the body during handling.

(5) Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.

(6) Use electric blasting caps of the same manufacture for each demolition shot involving more than one cap.

(7) Do not bury blasting caps. Use detonating cord to position blasting caps above the ground. Buried blasting caps are subject to unobserved pressures and movement which could lead to premature firing or misfires.

(8) Test electric blasting caps for continuity at least 25 feet from any other explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to be connected to the firing circuit.

c. When disposing of explosives by detonation, do not approach the disposal site for at least thirty minutes, after the expected detonation time, in the event of a misfire. When conducting non-electric procedures, the wait time shall be thirty minutes plus time fuse burn time.

d. A post-search of the detonation site shall be conducted to assure a complete disposal was accomplished.

e. If the situation dictates, protective measures to reduce shock, blast, and fragmentation shall be taken. Army Technical Manual (TM) 5-855-1, Fundamentals of Protective Design for Conventional Weapons, contains data on blast effects, ground shock, cratering, ejection, and fragmentation. The following distances shall be used unless protective measures are implemented.

(1) For non-fragmenting explosive materials, evacuation distance should be a minimum of 1250 feet.

(2) For fragmenting explosive materials, evacuation distance should be a minimum of 2500 feet. For bombs and projectiles with Caliber 5-inch or greater, use a minimum evacuation distance of 4000 feet.

(3) Items with lugs, strong backs, tail plate sections, etc., should be oriented away from personnel locations as these items tend to travel further than normal fragmentation.

f. Consideration should be given to tamping the UXO to control fragments, if the situation warrants. Fragments shall be minimized not only to protect personnel but also property, such as buildings, trees, etc.

g. Open burning of explosives and smokeless powder or chemical decomposition of explosives shall not be accomplished without prior approval of the contracting officer.

(1) Do not inhale the smoke or fumes of burning pyrotechnic or incendiary materials. The fumes and dust from many of these materials are irritating and/or toxic if inhaled.

(2) Do not use water on incendiary fires. Water may induce a violent reaction or be completely ineffective, depending on the mixture.

(3) Anticipate a high order detonation when burning pyrotechnics or incendiary-loaded UXO. Safety measures for personnel and property must be based upon this possibility.

h. Inert Ordnance will not be disposed of or sold for scrap until the internal fillers have been exposed and unconfined. Heat generated during a reclamation operation can cause the inert filler, moisture, or air to expand and burst the sealed casings. Venting or exposure may be accomplished in any way necessary to preclude rupture due to confined pressure.

11. Transportation.

a. If UXO must be transported off-site for disposal, the provisions of 49 CFR 100-199, DA Pam 385-64, state and local laws shall be followed.

b. Armed fuzes will only be transported when absolutely necessary and when all other avenues of "in place" disposal have been exhausted. Transportation to an on-site disposal area for these items is preferred.

c. Do not transport WP munitions unless it is immersed in water, mud, or wet sand.

d. If loose pyrotechnic, tracer, flare, and similar mixtures are to be transported, they shall be placed in #10 mineral oil or equivalent to minimize fire and explosion hazards.

e. Incendiary loaded munitions should be placed on a bed of sand and covered with sand to help control the burn if a fire should start.

f. If an unfired rocket motor must be transported, it shall be positioned in such a manner as to offer the maximum protection to personnel in the event of an accident.

g. If base-ejection type projectiles must be transported to a disposal area or collection point, the base will be oriented to the rear of the vehicle and the projectile secured, in the event the ejection charge functions in route.

h. If an UXO, with exposed hazardous filler (HE, etc), has to be moved to a disposal area, the item shall be placed in an appropriate container with packing materials to prevent migration of the hazardous filler. Padding should also be added to protect the exposed filler from heat, shock, and friction.

TAB

Appendix C

APPENDIX C
FIELD FORMS

ENGINEERING-SCIENCE
SOIL BORING LOG

327 244

FORM -
Fieldbook _______

LITHOLOGIC (BCHLTD) and SAMPLE LOCATION (BCHLDI)

Installation (AFIID): _______
Site (SITEID): _______
Location I.D. (LOCID): _______
Log Company (LOGCODE): Engineering-Science (ESCI)
Establishing Company (ESCCODE): Engineering-Science (ESCI)
Drilling Company (DRLCODE): _______
Construction Method (CMCCODE): _______
Logging Date(s) (LOGDATE): _______
Date Completed (ESTDATE): _______

Borehole Depth (DEPTH): (XXXX.XX)
Borehole Diameter (BHDIAM): (XX.XX)
Depth to Water (ft): _______
Date/Time Measured: _______
Location Description (LOCDESC): _______
Drillers: _______
Geologist/Engineer: _______
Signature: _______

SOIL SAMPLE INFORMATION										ORGANIC VAPOR (ppm)			Stratum
Time (hhmm) LOGTIME	Begin Depth(ft) (BEGDEPTH)	End Depth (ft) (ENDDEPTH)	Blows/6 in	Lithologic Description (Grain, Color, Consistency) - VISDESC	LITHCODE	ASTMCODE	% Recovery	Explosimeter	Borehole	Breathing	Headspace Sample	Stratification Order
	xxxx.xx	xxxx.xx			xxxx	xx or xxxx		%LEL			Unfilter-Filter-Out	xxx

OSHA Protection Level : _______ Page _____ of _____

FORM REVIEWED BY: _______ **DATE:** _______

D:\AT30\WP\629\137\FORMS\FORMA1.XS

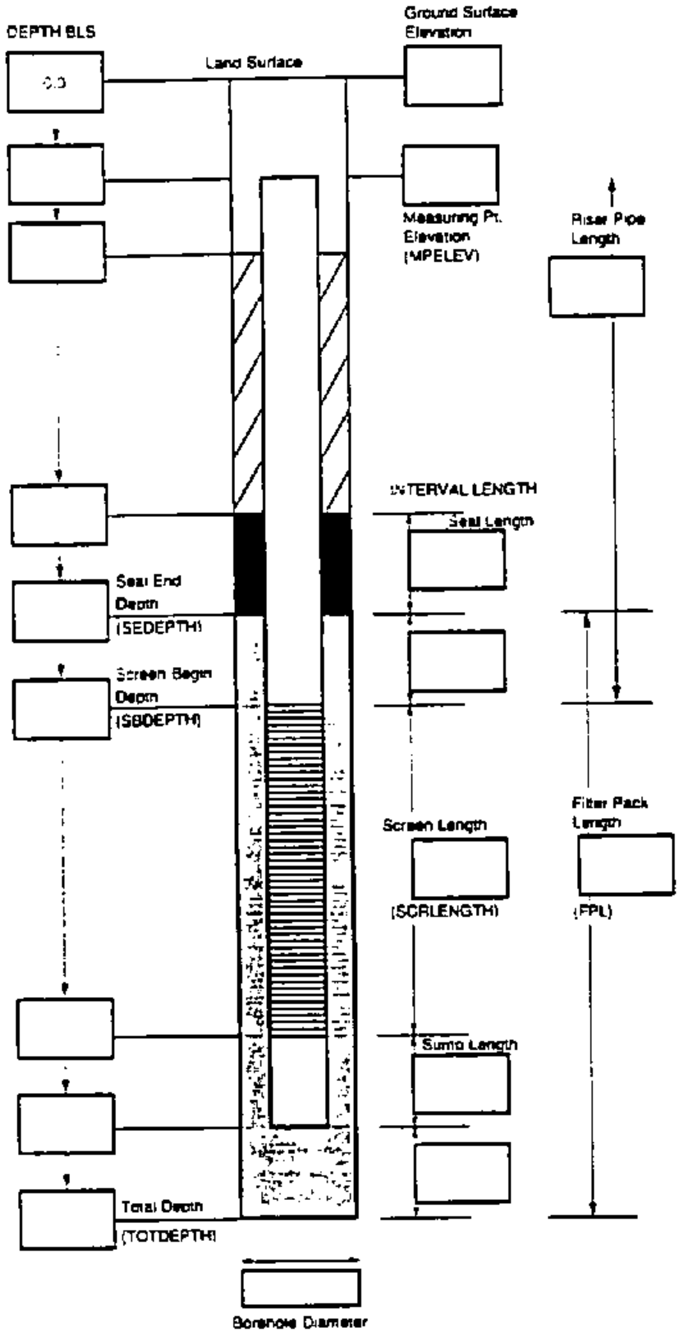
ENGINEERING-SCIENCE
WELL CONSTRUCTION LOG
STANDARD FLUSH MOUNT

327 245

FORM B
Fieldbook____

Installation (AFIID):____________________
Well I.D. (LOCID):____________________
Drilling Company:____________________
Drillers:____________________
Geologist/Engineer:____________________
Signature:____________________

Site:____________________
Installation Method:____________________
Casing Installation Date (INSDATE):____________________
Well Type (WTCCODE):____________________
Well Completion Method (WCMCODE):____________________
Geologic Completion Zone (GZCCODE):____________________



Well Completion
Guard Posts (Y / N) Date:____________
Surface Pad Size:__________ft x __________ft

Protective Casing or Cover
Diameter/Type:____________________
Depth BGS: __________ Weep Hole (Y / N)

Grout
Composition/Proportions:____________________
____
Placement Method:____________________
____

Seal Date:____________
Type:____________________
Source:____________________
Set-up/Hydration Time:____________________
Placement Method:____________________
Vol. Fluid Added:____________________

Filter Pack
Type:____________________
Source:____________________
Amount Used:____________________
Placement Method:____________________

Well Riser Pipe
Casing Material (CMACODE):____________________
Casing Inside Diameters (CASDIAM):__________in

Screen
Material:____________________
Inside Diameter (SCRDIAM):__________in
Screen Slot Size (SOUA):__________in
Percent Open Area (PCTOPEN):____________________

Sump or Bottom Cap (Y / N)
Type/Length:____________________

Backfill Plug (Y / N)
Material:____________________
Placement Method:____________________
Set-up/Hydration Time:____________________

Total Water Volume During Construction
Introduced (Gal):__________ Recovered (Gal):__________

Reviewed
By:____________________ Date:____________

Comments
____
____
____

G/AT509CT3/PM4/0993

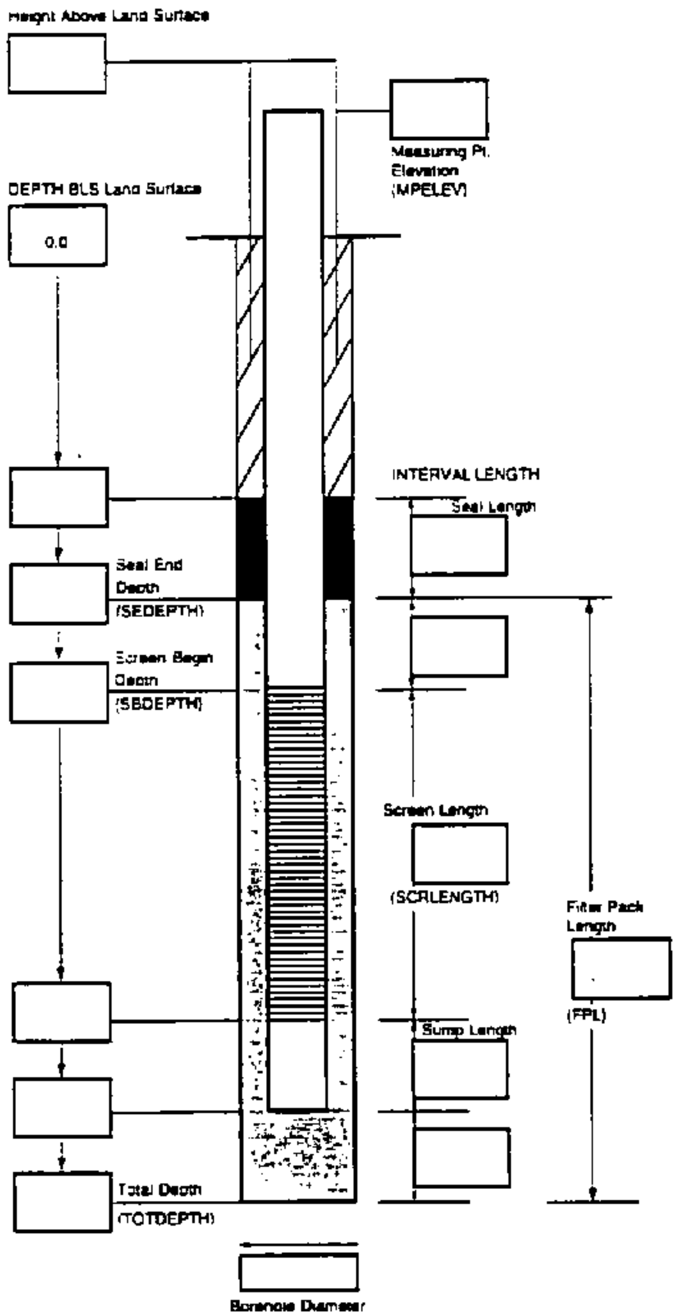
ENGINEERING-SCIENCE
WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

327 246

FORM C
Fieldbook_____

Installation (AFIID): ____________
Well I.D.(LOCID): ____________
Drilling Company: ____________
Drillers: ____________
Geologist/Engineer: ____________
Signature: ____________

Site: ____________
Installation Method: ____________
Casing Installation Date (INSDATE): ____________
Well Type (WTCCODE): ____________
Well Completion Method (WCMCODE): ____________
Geologic Completion Zone (GZCCODE): ____________



Well Completion
Guard Posts (Y / N) Date: ________
Surface Pad Size: ________ ft x ________ ft
Protective Casing or Cover
Diameter/Type: ____________
Depth BGS: ________ Weep Hole (Y / N)
Grout
Composition/Proportions: ____________
____
Placement Method: ____________
____
Seal Date: ________
Type: ____________
Source: ____________
Set-up/Hydration Time: ____________
Placement Method: ____________
Vol. Fluid Added: ____________
Filter Pack
Type: ____________
Source: ____________
Amount Used: ____________
Placement Method: ____________
Well Riser Pipe
Casing Material (CMACODE): ____________
Casing Inside Diameters (CASDIAM): ________ in
Screen
Material: ____________
Inside Diameter (SCRDIAM): ________ in
Screen Slot Size (SOUA): ________ in
Percent Open Area (PCTOPEN): ____________
Sump or Bottom Cap (Y / N)
Type/Length: ____________
Backfill Plug (Y / N)
Material: ____________
Placement Method: ____________
Set-up/Hydration Time: ____________
Total Water Volume During Construction
Introduced (Gal): ________ Recovered (Gal): ________
Reviewed
By: ____________ Date: ____________

Comments
____
____
____

G/AT509CT6/PM4/0993

327 247

FORM F
Fieldbook ____

ENGINEERING-SCIENCE
WELL DEVELOPMENT RECORD

Site: ____ Recorded by: ____

Installation (AFIID): ____ Development Subcontractor: ____

Well ID (LOCID): ____ Developers: ____

Organic Vapor Detector: (Type, SN) ____ Reading: ____

Explosimeter: (Type, SN) ____ Reading: ____

Water Level Indicator: (Type, SN) ____ Turbidity Meter: (Type, SN) ____

pH/Temperature Meter: (Type, SN) ____ Conductivity Meter: (Type, SN) ____

Weather: ____

From Drilling Logs:

Depth to Bottom of Seal bls (S): ____ ft Borehole Diameter (DB): ____ in.= ____ ft

Estimated Porosity (P): use 0.30 Total Depth of Borehole bls (TD): ____ ft

Measurements:

Depth to Water (ft BTOC): ____ ft Sounding Depth of Borehole (ft BTOC): ____ ft

Depth to Water (ft bls) (H): ____ ft Casing Diameter (DB): ____ in.= ____ ft

Well Bore Volume Calculation:

HC = Length of Water Column in Casing = TD-H = ____ ft

HF = Length of Water Column in Filter Pack = TD - S or H = ____ ft (Note: if S>H, use S. If S<H, use H.)

Volume of Water in Casing = VC = 3.14(DC/2)(DC/2)(HC) * (7.48); for 2" well, 10.25" borehole, VC = (0.1632)*(HC) = ____ gal (where DC, TD, H, S, DB are in feet)

Volume of Water in Filter Pack = VF = 3.14(DB/2)(DB/2)(HF)(P)*(7.48); for 2" well, 10.25" borehole, VF = (1.2372)*(HF) = ____ gal

Well Bore Volume = WBV = VC + VF = ____ gal

(1) Minimum Purge Volume = 3 x WBV = ____ gal (2) Volume Water Introduced During Construction = ____ gal

Required Development = Greater of (1) or (2) = ____ gal plus stabilization

...lopment Method: ____

...al Development Volume: ____ gal

Disposition of Development Water: ____

Date (DD-MMM-YY)	Time (hh:mm)	Volume Removed gal	Water Level ft BTOC	pH (SU)	Cond (umhos)	Temp (degree C)	Turbidity (NTU)	Comments (Clarity, Color, Odor)
		0						Initial Water Level Reading

DEVELOPMENT COMPLETE: (Y / N)

FORM REVIEWED BY: ____ Date: ____ Page ____ of ____

ENGINEERING-SCIENCE

EQUIPMENT CALIBRATION LOG SHEET 327 248

FORM I

Fieldbook________

Equipment Type:________________

Serial Number:________________

Calibration Type: Gas Liquid

Manufacturer of Standard:________________

DD-MMM-YY of Calibration	Time (hhmm)	Standard Concentration	Standard Lot Number	Expiration Date	Initial Reading	Corrected Reading	Person Calibrating	Comments

FORM REVIEWED BY:________________ DATE:________

D:\AT508\WP\826\187\FORMS\FORMI.XLS

FORM G
Fiel

ENGINE G-SCIENCE
PHO PH LOG

Date Taken (DD-MMM-YY)	Time Taken (hhmm)	Number	Photographer	Site Name	Sample Location and/or Scene Description

FORM REVIEWED BY: ______ DATE: ______ Page of

327 249

FORM H
Fieldbook

ENGINEERING-SCIENCE
.S SAMPLING LOG

Site Sample No	Date (DD-MMM-YY)	Time (hhmm)	Location Description	Sample Depth (feet)	Notes (Weather, Type of Sample, Collection Method, Decon Events)	Team	Hole Grouted? (DD-MMM-YY)

FORM REVIEWED BY: ______________________ DATE: ____________ Page of

O:\ATSOOW\P02\J1679\ORMSV\ORMH.XLS

TAB

Appendix D

APPENDIX D
RESUMES OF KEY TEAM MEMBERS

WALKER J. DUNCAN
Geologist

Experience Summary

More than 25 years experience in project management and design and implementation of hazardous waste and hydrogeological contamination assessments and investigations. Experience in managing and conducting projects under CERCLA, RCRA, and UST regulations in US EPA Region IV and other areas. Worked with regulatory personnel in EPA IV, Georgia, Alabama, Tennessee, Mississippi, and South Carolina. Experience with federal projects and private industry. Has performed QA/QC audits, construction oversight of remedial projects, and training of field personnel.

Years of Experience:

25

Years with Parsons:

13

Education

B.S., Geology, 1976, Georgia State University, Atlanta, Georgia

Registrations

Registered Professional Geologist (Georgia 1987, No. 648; South Carolina 1987, No. 123; Tennessee 1990, No. 1132)

Experience Record

Parsons Engineering Science, Inc. **Project Manager, Program Manager, Technical Director, Client Service Manager.**

Direction of multidiscipline staff responsible for conducting investigations at hazardous waste sites, RCRA and CERCLA sites, UST sites, DOD and industrial sites; geological and hydrogeological investigations, remediations. Responsible for all aspects of project and program management, client relations including both government and industrial clients.

Program Manager/Project Manager for Lockheed Martin Aeronautical Systems and Air Force Plant 6, Marietta, Georgia.

Program Manager for work that Parsons ES is conducting at Air Force Plant 6 for Lockheed Martin Aeronautical Systems. This work includes restoration, RCRA corrective actions, and facilities design and construction. Example projects include interim corrective measures at a RCRA regulated basin, interim corrective measures at a TCE spill site, RCRA permit preparation and review, investigations on-and off-site for groundwater contamination, design and construction services for a hazardous materials building, and stormwater investigations and piping designs. Mr. Duncan also represents parsons ES at the quarterly partnering meetings with LMAS, the USAF and Georgia EPD.

Technical Director and/or project manager for projects at AF Plant 6. He was project manager for the interim measures at the B-76 TCE Spill Site in the B-4 area. The project included an assessment of the site and design of an interim remedial measure. The interim measure included remedial design for soil contamination and groundwater containment. An alternatives analysis was conducted to evaluate and select a technology remediation of TCE in soil. The selected remedy was soil vapor extraction. The SVE pilot testing and well array were designed and implemented. A groundwater containment system was designed which included three recovery wells using vacuum to enhance drawdown and containment. A treatment system was designed to treat volatile organics in the vapor and liquid phases.

Technical Director for an offsite RFI at AF Plant 6 which included plume delineation, vertically and horizontally, and plume characterization. Monitoring well clusters were installed on properties downgradient from AF Plant 6. The wells were sampled and tested, i9ncluding down-hole geophysical testing, downhole packer testing of discrete facture zones, downhole groundwater flow monitoring, discrete zone sampling. This project was coordinated with offsite landowners, U.S. Geological Survey, and Georgia EPD.

Mr. Duncan has been involved with other projects at AF Plant 6 including: preparation and review of LMAS's Part B RCRA permit application, modification, and final permit; design and implementation of a treatment system for volatile organics in surface water prior to discharge at a NPDES outfall; preparation of a summary of hydrogeologic conditions in the B-4 area of AF Plant 6; quarterly monitoring and evaluation of wells in the B-10 and B-90 areas; an RFI for 23 SWMUs at AFP6; a stormwater system evaluation for Retention Basin No. 2 including stormwater sampling, piping reroute design, cross-connection study; and, closure of permitted drum storage areas.

Program/Project Manager for Restoration and Compliance work at Keesler AFB, Mississippi. Projects have included RFA investigations, RFI investigations, Baseline Risk Assessment including Human Health and Ecological, preparation of CMSs for four sites, Decision Documents for 15 sites, implementation (including design) of an interim corrective measure at a landfill in the Back Bay of Biloxi, two corrective measures at petroleum sites which have natural attenuation as final measures, RCRA permit application preparation. Mr. Duncan has been working with Keesler AFB since 1991 and represents Parsons ES at Quarterly Partnering Meetings, Restoration Advisory Board meetings, and public meetings. Additional work for Keesler has included preparation of permit applications for wetlands mitigation, environmental assessments at Keesler and ancillary facilities, UST compliance projects, and construction oversight services.

Program Manager for two major petroleum pipeline companies who transport petroleum products from Texas to New Jersey. The programs consist of petroleum assessment and remediation projects at spill sites along the pipeline right-of-way, booster station sites, and distribution facilities (tank farms).

Project Manager for a RCRA Facility Investigation at an industrial facility in Anderson, South Carolina. Project involved preparation of work plans, investigation of solid waste management units including landfills, lagoons, drum storage areas, disposal pits, and piping systems. Development of interim measures work plan for remediation of sludge disposal area, hydrogeological investigation of groundwater plume containing volatile organic compounds and metals. Negotiated with regulatory agencies (SCDHEC and USEPA) to reduce number of SWMUs in program and to reduce number of wells required for hydrological study.

Project Manager for preparation of Work Plan for RCRA Facility Investigation for industrial facility in Inman, South Carolina. Negotiated for client with USEPA and SCDHEC to reduce number of SWMUs, to phase the investigation, and to allow testing of monitoring wells (resulting in reduction of number of deep monitoring wells). Helped client prepare bidding documents for project.

Project Manager/Technical Director for RFI at waste sites at Savannah River Plant near Aiken, South Carolina.

Construction Oversight Manager at a hazardous waste landfill for an industrial client in west Texas. Project involved solidification of landfilled waste with a twelve-foot diameter mixing auger, installation of a RCRA cap on the landfill, and installation of a groundwater monitoring-recovery system.

Project Manger and Technical Director for UST investigations for Shell Oil Company, STAR

Enterprises, MARTA, and other industrial sites in the southeast.

Project Manager for a groundwater contamination assessment for the US Navy on Andros Island, Bahamas. The project involved assessing the presence of organic chemicals in soils and groundwater in a carbonate terrain, installation and sampling of monitoring wells.

Technical Director for three USAF IRP projects on the Island of Oahu, Hawaii. The projects included RI/FS investigations under CERCLA, the installation of deep monitoring wells around large petroleum tanks (1,000,000 gallons), and baseline risk assessments.

Project Hydrogeologist for hazardous waste investigations at Department of Defense facilities. Project responsibilities have included supervision of field data collection and interpretation for the U.S. Air Force's Installation Restoration Program at Edwards AFB, March AFB, and AF Plant 42, in California. These programs included soil sampling, monitoring well layout and installation, geophysical log interpretation, aquifer tests and data interpretation, groundwater sampling, plume delineation, and report preparation.

Task Manager for the removal and remediation of approximately 35 underground storage tanks and oil/water separators at Chanute AFB, Illinois. Project involved oversight of remediation contractors, liaison between the USCOE and USAF, and preparation of decision documents and summary closure reports.

Technical Advisor and Training for field investigations at two NPL landfills for Wright-Patterson Air Force Base, Ohio. Responsibilities included review of Field Operating Procedures, training of personnel in field methodologies and safety issues, and technical audits of field work.

Other project responsibilities have included field sampling supervision at a NPL landfill in New Jersey, regulatory review of a NPL landfill in Tampa, Florida, field supervision of well installation, and aquifer testing for industrial clients in Tennessee, South Carolina, and Florida.

1980-1985. WAPORA, Inc., Environmental Consultants, Norcross, Georgia. **Geologist**. Responsibilities included preparation of groundwater, soils, and geology sections for Environmental Impact Statements and Environmental Assessments, and design and review of groundwater monitoring plans, preparation of RCRA Part B permits, groundwater assessments including well installation, surface water and groundwater monitoring plan design and implementation.

1977-1980. Atlanta Testing and Engineering Company, Geotechnical Engineers, Norcross, Georgia. **Staff Geologist**. Responsibilities included boring layout, drilling supervision, logging of drill holes, seismic investigations, aquifer testing, packer testing of boreholes, investigations for land applications of industrial waste, geotechnical investigations at small dam sites, and investigations at large Georgia Power reservoir sites.

1976-1977. Howard Schoenike and Associates, Consulting Geologists, Houston, Texas. **Mine Geologist** at a surface coal mine in northwest Georgia. Responsible for site and regional coal exploration.

1975-1976. Geoconsultants, Inc., Geotechnical Engineers, Atlanta, Georgia. **Driller and Geologic Technician** for small geotechnical consulting firm.

1973-1975. Soil Systems, Inc., Geotechnical Engineers, Marietta, Georgia. **Driller and Geologic Technician** for a geotechnical consulting firm.

Professional Affiliations

National Ground Water Association

Licensed Geologist (North Carolina 1987, No. 551)

LAURA J. KELLEY
Environmental Scientist

Experience Summary

Over nine years experience in environmental field with an emphasis on quality assurance/quality control. Experience in providing guidance on federal and state analytical regulations, managing and completing projects on schedule and within budget, conducting pollution prevention studies, developing pollution prevention plans, providing technical and scientific project assistance, and performing multi-media environmental sampling. Performed data validation and review of data validation/site summaries for hazardous waste site projects by evaluating analytical laboratory data for conformance with specific QA/QC project procedures and USEPA CLP National Functional Guidelines. Experienced in writing Quality Assurance Project Plans (QAPPs) and technical reports for clients.

Years of Experience:

9

Years with Parsons:

4

Education

B.S., Biological Life Sciences, 1986, North Carolina State University, Raleigh, NC

Experience Record

1994-Date. Parsons Engineering Science, Inc., **Project Manager** for Georgia-Pacific's compliance with the EPA Cluster Rule. Responsibilities include assisting in interpretation of the Rule, selection of the appropriate laboratories, preparation of the laboratory contracts, auditing of the laboratories, and preparation of the QA Manual to be used by all G-P mills for sampling.

Project Manager for the Dubose Quarterly Groundwater monitoring. Responsibilities include coordinating field work, validation of the data, preparation of monthly progress reports, and preparation of quarterly monitoring reports, including time versus concentration plots for each compound detected in each well.

Project Scientist for Pollution Prevention Opportunity Assessment Reports for Tyndall AFB. Conducted field surveys of all shops on base to identify areas of potential reduction. Used opportunity assessment information to track applicable solvent and equipment substitutes, alternative chemicals, and improved operational practices. Followed up with the development of Pollution Prevention Management Action Plan. Assisted in determining baselines, current reductions, and opportunity estimated percent reduction in order to determine pollution prevention goals.

Project Scientist for preparation of Section 313 EPCRA, Toxic Chemical Release Reporting for Columbus AFB. Project consisted of identifying and inventorying base usage of hazardous chemicals and preparing associated Toxic Release Inventory (TRI) Form R. Responsibilities included conducting field investigation to collect hazardous chemical inventory information, examining processes and developing process flow diagrams to quantify release pathways, determining total aggregate releases of toxic chemicals from on-base discharges, and preparing the final technical report.

Project Scientist for preparation of Ozone Depleting Chemical (ODC) Management Plan for Fort McPherson. Responsibilities included conducting field investigations, preparing inventories of equipment and processes using ODCs, recovery/recycling equipment, identifying alternatives for ODCs in use, and assisting in completion of a used refrigerant and recyclying /reclamation/disposal options study.

Project Scientist for South Marble Top Road Landfill and Shaver's Farm Landfill Sites. Prepared Performance Standards Verification Plan to insure all Record of Decision requirements were met. Managed all data from the laboratory. Performed data validation on quick turnaround basis and provided guidance to the field for immediate disposition decisions of the soil, waste and water.

Project Scientist for data management for Chanute Air Force Base in Rantoul, Illinois. Responsibilities for this site include immediate data quality assessment of analytical results from the laboratory for "in the field" decisions on further action, as well as managing all analytical data.

Project Scientist for Air Force Plant No. 6. Performed quarterly groundwater monitoring of four areas on site. Conducted data validation for all monitoring well data and consolidated information for the preparation of the IRPIMS deliverable. Assisted in the production of the semi-annual monitoring reports including statistical analysis, QA/QC discussion, and analytical data tables.

Environmental Scientist for Cape Canaveral Air Force Station (CCAFS). Responsibilities include validation of data using AFCEE and Florida guidelines, as well as final review of all SDG and site summaries. Also involved in the preparation of the Environmental Conditions of Property Report (ECP) for CCAFS.

1991-1994. IEA, Inc., **GC Supervisor**. Responsible for managing all operations of the gas chromatography department, including hiring and training of personnel, ordering equipment, installation and maintenance of instrumentation. Other duties included writing and updating all Standard Operating Procedures (SOPs) for the department including volatile organics, petroleum hydrocarbons (TPH) and GC semivolatiles; technical review and revision of QAPjPs; final review of CLP and other data packages and generation of databases; conducted routine departmental audits, as well as client tours and/or audits; and addressed technical inquiries from clients.

1988-1991. **Assistant Supervisor/GC Chemist**. Responsible for coordinating and analyzing samples for volatile organics, TPH, phenols, polynuclear aromatic hydrocarbons, acrolein/acrylonitrile, ethylene dibromide and special projects; prepared data packages; performed routine maintenance and troubleshooting procedures for instrumentation.

1986-1988. USDA-ARS, **Biological Lab Technician.** Responsible for designing and conducting biochemistry experiments, using gas and thin-layer chromatography, spectrophotometry, and radiological assays; maintaining all lab facilities, including repair of analytical instrumentation; and recording, reporting and archiving all results.

TAMIR L. KLAFF
Engineering Geologist/Geophysicist

Experience Summary

Experienced in hazardous waste studies including remedial investigations, RCRA investigations, remedial actions and UST investigations. Experience includes extensive fieldwork in geology, surface/downhole geophysics, implementation of aquifer characterization tests, soil vapor extraction (SVE) tests, air sparging tests, intrinsic remediation testing, monitoring/recovery well installation, and installation and monitoring of hydrocarbon recovery systems.

Years of Experience:

9

Years with Parsons:

5

Education

B.A., Geology, June 1991, Franklin & Marshall College, Lancaster, Pennsylvania

M.S., Engineering Geology and Hydrogeology, December 1993, Texas A&M University, College Station, Texas

Experience Record

Oct. 1993-Date. Parsons Engineering Science, Inc. **Engineering Geologist/Geophysicist.** Responsible for planning and implementing geophysical and hydrogeological studies, oversight of field efforts pertaining to groundwater investigations and geophysical surveys. Experienced in installation of monitoring/recovery wells in unconsolidated sediments and bedrock aquifers, performance of aquifer tests and remedial pilot testing and performance analysis of surface and downhole geophysical techniques. Wrote or assisted in writing work plans, risk assessments, data reports, geophysical reports, RFIs, and corrective action plans.

Project Manager and Lead Geologist for pipeline leak investigations in Alabama and Georgia. Supervised the installation and development of groundwater monitoring wells and recovery trench. Conducted down-hole borehole logging using gamma ray and conductivity techniques, downhole video, and packer testing. Conducted feasibility studies on air sparging and SVE technologies and performed contaminant transport modeling for sites. Prepared corrective action plans and assisted in design of soil vapor extraction/product recovery/air sparge remedial system.

Deputy Project Manager and Lead Geologist for chlorinated solvent and hydrocarbon release investigation at U.S. Air Force Plant No. 6 in Marietta, Georgia. Supervised investigation using Cone Penetrometer Truck equipped with Rapid Optical Screening Tool (ROST) Laser Induced Fluorescence System and Direct Push Sampling. Performed intrinsic remediation sampling and analyses and prepared Supplemental RCRA Facility Investigation report.

Deputy Project Manager and Field Team Leader for Survey of Non-Liquid PCBs (NLPCBs) in Materials investigation at Robins AFB in Warner Robins, Georgia. Responsible for preparing Sampling and Analysis Plan, performing records search, leading interviews and sampling teams, and preparing final NLPCB report.

Site Manager and Lead Geophysicist at Defense Distribution Depot Memphis Tennessee (DDMT) site and Hancock Bombing and Gunnery Range DOD facility in Hancock County, Mississippi. Responsible for oversight of geophysical investigation to detect unexploded ordnance (UXO) and chemical warfare materials (CWM), daily operation and management of site activities, and preparation of final EE/CA report.

Lead Geophysicist at Camp McCain, Mississippi UXO site. Responsible for leading geophysical survey teams in investigation of UXO site using magnetics and electromagnetics techniques, processing and interpreting data, and EE/CA report preparation.

Field Team Leader and **Project Geophysicist** at UXO sites at Motlow, Tennessee, Camp Croft, South Carolina, Duck, South Carolina, and Fort Campbell, Kentucky. Reponsible for acquisition of UXO related field data using EM-61 terrain conductivity, analysis of data, and preparation of investigation reports.

Project Geophysicist and **Field Team Leader** at Charleston AFB, South Carolina. Responsible for acquisition of geophysical data using EM-31 terrain conductivity and magnetometer to determine boundaries of buried landfill and preparation of investigation report.

Sept. 1991-Aug. 1993. (Graduate Student) Texas A&M University Center for Engineering Geosciences. Thesis research consisted of application of surface geophysical techniques to delineate features and boundaries of Indian archaeological sites in the subsurface. Research was funded by the U.S. Army Corps of Engineers, Lake Sharpe, South Dakota office. Research was conducted along the shores of Lake Sharpe, SD.

June - Aug 1990. Scripps Institute of Oceanography, LaJolla, California, summer research fellowship. Conducted research on radioactive dating of deep sea sediment by the record of radioactive decay of uranium in fish teeth. Also developed laboratory methods to separate clay minerals.

July 1989-May 1990. Funded by the KECK Research Association. Performed geochemical and petrographic analyses of a granitic pluton in southeast Vermont.

Professional Affiliations

AEG (Association of Engineering Geologists) No. 5525

Honorary Affiliations

Phi Beta Kappa, Franklin & Marshall College

Papers And Publications

Definition of a Dissolved Hydrocarbon Plume Using the Rapid Optical Screening Tool (ROST) Laser Induced Fluorescence (LIF) System presented at the 1997 Association of Engineering Geologists Annual Conference in Portland, Oregon and at the 1998 GWPCA Industrial Pollution Control Conference.

Evaluation of Coastal Plain Stratigraphy in Central Georgia Using Natural Gamma Logging, presented at the 1995 Association of Engineering Geologists/California Groundwater Association Annual Conference in Sacramento, California.

The Assessment of Various Geophysical Techniques for Plains Indian Archaeological Site Investigations, presented at the 1993 National Association of Engineering Geologists conference in San Antonio, Texas.

The Assessment of Various Geophysical Techniques for Plains Indian Archaeological Site Investigations, M.S. Thesis, Texas A&M University, 1993.

ROSS E. SURRENCY
Geologist

Experience Summary

Eight years environmental consulting experience involving the planning and implementation of hazardous and industrial waste studies and investigations at RCRA and CERCLA sites. Responsibilities have included project management, project planning, field technical oversight, subcontract management, data evaluation and reporting.

Years of Experience:

8

Years with Parsons:

8

Education

B.S., Geology, June 1990, Georgia Southern College, Statesboro, Georgia

Registrations

Registered Professional Geologist (Georgia 1996, No. 1294; South Carolina 1996, No. 2064; Florida [pending])

Experience Record

June 1998-Date. Parsons Engineering Science, Inc. **Project Manager** for a site assessment at a manufacturing facility in Virginia. Conducted soil and groundwater sampling using direct push technology.

June 1996-May 1998. Parsons Infrastructure and Technology Group, Inc. **Project Manager** coordinating the production of an RFI/RI/BRA report for the Department of Energy (DOE) Savannah River Site (SRS). Report involved multiple authors from separate locations in the southeast.

Lead Geologist providing technical oversight of field activities at the SRS for various projects including oversight of; drilling activities at an inactive nuclear reactor seepage basins site, soil sampling activities and cone penetrometer technology (CPT) borings at four low-level radioactive waste pits, groundwater sampling activities using CPT at a burning/rubble pit site, and recirculation well installation for remediation of a multi-acre groundwater waste solvent plume. Also responsible for preparing project work plans, sampling and analysis plans and reports.

Jan. 1990-May 1996. Parsons Engineering Science, Inc. **Project Manager** providing management activities and technical oversight of field activities during the groundwater characterization of seepage basins associated with an inactive nuclear reactor at SRS. Field activities included monitoring well installation, geophysical borehole logging, CPT borings, and aquifer testing and data analysis. Geophysical logs were processed and reviewed in the field to determine optimal depths for well screen placement. Aquifer testing involved slug tests of wells screened in both confined and unconfined aquifers. Worked in conjunction with two other consulting firms to complete the field activities.

Task Manager for assessment activities at 13 underground storage tank (UST) sites at Chanute AFB in Illinois under the Air Force Installation Restoration Program (IRP). Prepared drilling and sampling program and coordinated field activities. Obtained approval of project plans and reports from both Illinois EPA and Region V USEPA.

Lead Geologist for a project at an industrial chemical facility in Atlanta, GA. The facility was under a consent order from Georgia EPD to perform corrective actions. Dense non-aqueous phase liquids (DNAPL) had been identified in the groundwater. Coordinated quarterly sampling of select monitoring wells on the property.

Performed O&M of a groundwater pump and treat system, conducted weekly sampling of system influent and effluent and summarized results in monthly reports to the EPD.

Project Geologist responsible for preparing project plans, coordinating and overseeing field activities and writing reports for Department of Defense (DOD)/DOE contracts and industrial clients. Site investigations have included RCRA Facility Investigations (RFIs), site assessments at retail gas stations and oversight of UST removal activities (over 30). Have assisted in RFIs at Chanute AFB, Keesler AFB, Langley AFB, and Eglin AFB under the Air Force IRP. Other types of sites investigated include landfills, fire training areas, petroleum pipeline leak sites, herbicide orange disposal sites and sludge disposal pits.

Provided **construction oversight** for the US Army Corps of Engineers for the removal of 21 USTs and over 13,000 feet of underground fuel pipeline at Chanute AFB, Illinois. Directed remediation contractor and performed confirmatory soil sampling. Conveyed updates of project status during weekly meetings with the Corps of Engineers Resident Engineer and US Air Force personnel.

Served as a **field geologist** on two intrinsic remediation (natural attenuation) demonstration projects at DOD facilities working in conjunction with USEPA, Robert S. Kerr Environmental Research Laboratory and Air Force Center for Environmental Excellence (AFCEE) staff members. Activities included petroleum hydrocarbon plume definition by collecting groundwater and soil samples with a Geoprobe rig and performing on-site analyses.

Well experienced in groundwater monitoring well installation by the following drilling methods: air rotary, hollow stem auger, mud rotary, Geoprobe, and coring. Have provided oversight for the installation of over 140 wells including groundwater monitoring wells (some double-cased), piezometers, vapor extraction monitoring points, air sparging points, observation wells for pumping tests and 8-inch diameter double-screened recirculation wells. Also experienced in CPT and Geoprobe sampling technology. Experienced in several well development and sampling techniques. Knowledgeable in aquifer analysis using AQTESOLV™ computer software. Have assisted in implementation of remedial technologies including air sparging, bioventing, low temperature thermal volatilization, groundwater pump and treat, and intrinsic remediation studies. Familiar with the following geophysical methods: electromagnetic, magnetic, downhole gamma logging, and seismic refraction. Also familiar with global positioning system (GPS) instrumentation and software.

Professional Affiliations

Central Savannah River Area Geological Society

SCOTT E. ROWDEN
Project Manager/Industrial Hygienist

Experience Summary

Over 17 years of experience in environmental studies, regulatory affairs and compliance, and assessment of health and safety hazards, and in the management and implementation of public health, industrial hygiene, and environmental programs and projects. In addition, significant familiarity has been acquired with environmental regulations (e. g., air quality, solid and hazardous waste, drinking water, and wastewater treatment). Within the last five years, responsibilities have included project management of CERCLA investigations and studies at Department of Defense facilities and management of an environmental studies and permitting department in an environmental engineering consulting firm.

Years of Experience:

17

Years with Parsons:

11

Education

B.S, Environmental Health, 1975, East Tennessee State University, Johnson City, Tennessee
M.S.P.H., Industrial Hygiene Program, 1982, University of North Carolina, Chapel Hill, North Carolina

Registerations

Registered Environmental Health Specialist by National Environmental Health Association

Experience Record

1987-Date. Parsons Engineering Science, Inc. (1991-Date). **Manager Environmental Studies and Permitting Department.** Manages a department which provides consultation on environmental and occupational safety and health, regulatory compliance and environmental permitting to industrial/government clients. Projects accomplished by this department include: risk assessment, spill control and emergency response, training, environmental planning and permitting, environmental studies, compliance inspections and audits, plant and facility siting, and occupational safety and health monitoring and compliance. In addition, serves as the Project Manager for an RI/FS on a U.S. Air Force base in Illinois which is scheduled for closure. This investigation includes 19 underground storage tank sites and 11 other sites which are being investigated under CERCLA. Total project value is in excess of $6 million.

Project Manager/Industrial Hygienist (1987-1991). Responsible for assessing health risks, recommending measures to control employee exposures and serving as a project/task manager for hazardous waste investigations and studies, risk assessments, and environmental audits. Specific projects/activities accomplished during this period were:

Served as **Project Manager** for a U.S. Air Force hazardous waste investigation on a base in Indiana. Sites investigated on this base included 3 landfills, 2 fire training area and a petroleum fuel pipeline.

Authored numerous site health and safety plans for hazardous waste site investigations and remediations. Acted as the project health and safety officer for several superfund investigations which involved the use of Level B worker protection for personnel performing investigative activities.

Conducted environmental audits of numerous commercial/industrial properties involved in property transfers. Several of these audits involved multiple sites/facilities at geographical locations throughout the U.S. and the coordination and management of multiple auditing teams.

Conducted regulatory compliance audits of two RCRA hazardous waste TSD facilities. Audit reports were provided to group of Fortune 500 companies and were used by these companies to select a facility for treatment, storage or disposal.

Conducted and managed industrial hygiene surveys, air monitoring and occupational health and safety training development for manufacturing facilities in the midwest and southeast U.S.

Principal author for the development of community air monitoring plans implemented during the remediation of large Superfund sites in Louisiana and Ohio.

Manager and principal author for environmental risk assessments of a DOD herbicide test site in Florida; a RCRA chemical manufacturing site in Louisiana; four multi-site remedial investigations on U.S. Air Force bases in Illinois, Michigan, and Minnesota; airborne exposures associated with remedial actions at Superfund sites in Ohio and Louisiana; and a RCRA commercial hazardous waste incinerator site in Ohio.

Project Manager for Herbicide Orange investigation and groundwater recovery system evaluation at a U.S. Air Force base in Florida. Investigation focused on a test grid area, a loading/unloading area, and other potential disposal sites on the base.

1984-1987. U. S. Army. **Chief, Health Hazard Assessment Office - Major.** Managed U.S. Army Environmental Hygiene (USAEHA) office which provided health hazard assessment (HHA) reports on new material being developed and designed for the Army. These written reports identified health hazards, assessed the extent of identified health risks and offered recommendations to protect soldiers who would operate and maintain the new material. Responsibilities of this position included: coordination with material developers, test organizations, and the Office of the Surgeon General (approval authority for health hazard assessment reports); production of technically accurate and complete HHA reports; identification of research projects when a biomedical database gap existed; and recommending military-unique health standards to the Office of the Army Surgeon General.

1982-1984. U. S. Army. **Industrial Hygienist-Captain.** Served as industrial hygiene project officer in the USAEHA division which provided support to Army industrial hygiene programs throughout the world. Responsibilities of this position included: planning and conducting surveys of Army industrial operations; preparation of survey reports which identified the magnitude of exposures and provided recommendations to eliminate or minimize exposures; providing technical consultation to Army industrial hygiene and management personnel; and formulation of various industrial hygiene program and policy documents.

1978-1980. U. S. Army. **Detachment Commander-Captain.** Commanded an eight-person preventive medicine detachment. Responsible for managing the U.S. Army preventive medicine program in the southern half of the Republic of Korea. Program encompassed sanitation, radiological hygiene, drinking water, communicable disease, medical entomology, environmental physiology, and industrial hygiene.

1975-1978. U. S. Army. **Environmental Science Officer-Lieutenant.** Managed, directed and operated a comprehensive environmental health program. Supervised a senior technician and five junior technicians. Major program elements included food service sanitation, sanitation of troop billets, communicable disease investigation, entomology, drinking and wastewater surveillance, liaison with local health officials, environmental compliance, and industrial hygiene.

327 264

Professional Affiliations

Certified Industrial Hygienist (CIH) by American Board of Industrial Hygiene, 1983 (Certificate No. 2566)
American Industrial Hygiene Association
American Board of Industrial Hygienists
American Conference of Governmental Industrial Hygienists

Papers and Publications

"Study of the Effects of Increased Filter Spacing and Baffle Addition on the Operation of a Pulse Jet Two Cartridge Filter System," November 1982, Masters Thesis at University of North Carolina.
"U. S. Army Health Hazard Assessment Program," presented at Military Section of American Industrial Hygiene Association National Conference, May 1985.
"Occupational Health for the Soldier in the Field," paper in Medical Bulletin of Military Occupational Health, February 1988 (R. M. McIntosh, M. D. and S. E. Rowden coauthors).
"Introduction to Risk Assessment at Hazardous Waste Sites,", February 1991 Continuing Engineering Education Seminar, Clemson University.
"The Consulting Engineer's Role in Environmental Auditing," presented at Air and Waste Management Association meeting, June 1991, (coauthors C. M. Mangan and S. E. Rowden).

TAB

Appendix E

APPENDIX E
STATEMENT OF WORK

ORDER FOR SUPPLIES OR SERVICES

(Contractor must submit four copies of invoice.)

327 267

Form Approved OMB No. 0704-0187 Expires Aug 31, 1992

PAGE 1 OF 1

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0187), Washington, DC 20503. Please DO NOT RETURN your form to either of these addresses. Send your completed form to the procurement official identified in item 6.

1. CONTRACT/PURCH ORDER NO.	2. DELIVERY ORDER NO.	3. DATE OF ORDER	4. REQUISITION/PURCH REQUEST NO.	5. CERTIFIED FOR NATIONAL DEFENSE UNDER DMS REG 1
DACA87-95-D-0018	0019	970925	W31RY072616695	DO

6. ISSUED BY CODE
US Army Engineering and Support
Center, Huntsville
ATTN: CEHNC-PM-AE/Parker/205-895-1387
PO Box 1600, Huntsville, AL 35807-4301

7. ADMINISTERED BY *(If other than 6)* CODE

8. DELIVERY FOB ☐ DEST ☐ OTHER *(See Schedule if other)*

9. CONTRACTOR CODE — FACILITY CODE

NAME AND ADDRESS:
Parsons Engineering Science, Inc.
57 Executive Park South, NE
Suite 500
Atlanta, GA 30329

10. DELIVER TO FOB POINT BY (Date) See Annex Z

11. MARK IF BUSINESS IS ☐ SMALL ☐ SMALL DISADVANTAGED ☐ WOMEN-OWNED

12. DISCOUNT TERMS N/A

13. MAIL INVOICES TO See Block 9, SF 252

14. SHIP TO CODE
See Appendix A, Annex Z

15. PAYMENT WILL BE MADE BY CODE
US Army Corps of Engineers
Finance Center
7800 Third Avenue
Millington, TN 38054-8001

MARK ALL PACKAGES AND PAPERS WITH CONTRACT OR ORDER NUMBER

16. TYPE OF ORDER
DELIVERY [X] This delivery order is issued on another Government agency or in accordance with and subject to terms and conditions of above numbered contract.
PURCHASE [ ] Reference your ___ furnish the following on terms specified herein.

ACCEPTANCE. THE CONTRACTOR HEREBY ACCEPTS THE OFFER REPRESENTED BY THE NUMBERED PURCHASE ORDER AS IT MAY PREVIOUSLY HAVE BEEN OR IS NOW MODIFIED, SUBJECT TO ALL OF THE TERMS AND CONDITIONS SET FORTH, AND AGREES TO PERFORM THE SAME.

NAME OF CONTRACTOR	SIGNATURE	TYPED NAME AND TITLE	DATE SIGNED
Parsons Engineering Science	[signature]	Robert L. Glenn, Vice President	9/30/97

[X] If this box is marked, supplier must sign Acceptance and return the following number of copies: original

17. ACCOUNTING AND APPROPRIATION DATA/LOCAL USE

21 NA 97 2020.0000 A0 97 08 8130 49300812000 01110 25CZ 001JTD

18. ITEM NO.	19. SCHEDULE OF SUPPLIES/SERVICE	20. QUANTITY ORDERED/ACCEPTED*	21. UNIT	22. UNIT PRICE	23. AMOUNT
	Your revised proposal, dated 10 September 1997, is accepted and fully funded in the amount of \$442,354 (\$420,641 in estimated reimbursable costs and \$21,713 in fixed-fee). Appendix A, Annex Z, pages AZ-1 through AZ-40 are attached hereto and made a part hereof. Task order completion date is 30 November 1998.				

* *If quantity accepted by the Government is same as quantity ordered, indicate by X. If different, enter actual quantity accepted below quantity ordered and encircle.*

24. UNITED STATES OF AMERICA
BY: [signature: Lynda Bond] CONTRACTING/ORDERING OFFICER

25. TOTAL \$442,354
29. DIFFERENCES
30. INITIALS

26. QUANTITY IN COLUMN 20 HAS BEEN ☐ INSPECTED ☐ RECEIVED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED

DATE — SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

27. SHIP. NO. ☐ PARTIAL ☐ FINAL
28. D.O. VOUCHER NO.
31. PAYMENT ☐ COMPLETE ☐ PARTIAL ☐ FINAL
32. PAID BY
33. AMOUNT VERIFIED CORRECT FOR
34. CHECK NUMBER
35. BILL OF LADING NO.

36. I certify this account is correct and proper for payment.
DATE — SIGNATURE AND TITLE OF CERTIFYING OFFICER

37. RECEIVED AT	38. RECEIVED BY	39. DATE RECEIVED	40. TOTAL CONTAINERS	41. S/R ACCOUNT NUMBER	42. S/R VOUCHER NO.

APPENDIX A

ANNEX Z

STATEMENT OF WORK

CHEMICAL WARFARE MATERIEL

ENGINEERING EVALUATION/COST ANALYSIS

DEFENSE DEPOT MEMPHIS, TENNESSEE (DDMT)

1.0 **BACKGROUND**. The work required under this Scope Of Work (SOW) falls under the Base Realignment and Closure (BRAC) and in support of a Remedial Investigation/Feasibility Study (RI/FS) at Defense Depot Memphis, Tennessee (DDMT). Chemical Warfare Materiel (CWM) and, Ordnance and Explosives (OE) are suspected to exist on this property formerly owned by the Department of the Army and is currently owned by the Department of Defense (DOD).

1.1 General. OE is a safety hazard and may present an imminent endangerment to the public. CWM is a safety hazard and, if present, constitutes a hazard to the public and the environment. These actions will be performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the National Priority List (NPL); the Federal Facilities Agreement (FFA) between DDMT, EPA, and the State of Tennessee; and the National Contingency Plan (NCP). For any actions on site, administrative requirements of Federal, State, or Local permits are not required, but the substantive permit requirements shall be fulfilled. The provisions of 29 CFR 1910.120 shall apply to all actions taken at this site.

1.2 This site is a suspected CWM site. It is the intent of the Government that the A-E shall maintain a safe distance from all anomalies and not perform intrusive work directly on known anomalies. If the A-E encounters suspected CWM during work, the

A-E shall immediately withdraw from the work area and notify the Corps of Engineers on-site Safety Specialist or on-site CBDCOM team for guidance.

1.3 Site Description. The Defense Depot Memphis, Tennessee is located within the city limits of Memphis, Tennessee. The Depot is on the south side of the town, on Airways Road. It is two miles northwest of the Memphis International Airport. The Depot is still in active use by the Department of Defense and operated by the Defense Logistics Agency and under the control of the Defense Distribution Region East (DDRE). The depot is undergoing Base Realignment and Closure (BRAC) activities.

1.3.1 Main Depot Area. Archives Record search indicates no evidence of the burial or destruction of conventional ordnance or chemical warfare materials on the main depot.

1.3.2 Dunn Field (Operable Unit 1). All records indicate that only the Dunn Field Area was used to destroy or bury conventional ordnance and chemical warfare materiel(CWM). The first known destruction of CWM was in 1946, Operable Unit 1 (OU-1)(at unnumbered site)(shown in ASR as Area A), with the neutralization/destruction of the German Mustard Bombs. The last known disposal of CWM is the burial of Chemical Agent Identification Sets(CAIS) in 1955 or 1956, at OU-1, site #1 (also shown in ASR as Area B). Between 1946 and 1956, other chemicals associated with the Chemical Warfare Service were also buried in Dunn Field. These include Impregnite (both CC-2 and XXCC-3, used for impregnating clothing against chemical agents); and Decontamination Agent, Non-Corrosive (DANC)(consisting of RH195 and Acetylene Tetrachloride). In addition, food stocks (rations), acids, paints, herbicides, and medical waste were also destroyed or buried in pits. Conventional ordnance (war trophies) were also destroyed in the Dunn Field Area following World War II.

1.3.2.1 Dunn Field, unnumbered site,(Area A), measures approximately 200 feet wide by 1350 feet long and approximately 6-1/2 acres. In July 1946, a rail shipment of 250 Kg and 500 Kg, Mustard filled German bombs, en route from Mobile, AL to Pine Bluff, AR, was diverted to DDMT due to some of the bombs leaking and contaminating the rail line. The leaking bombs (24 - 500Kg and 5 - 250 Kg) were drained at DDMT by shooting into the bomb casing, draining the mustard into a slurry pit (40 feet long by 8 feet wide by 12 feet deep). The empty bomb casings were destroyed by detonation (the 500kg bombs did not have explosives, the 250kg bombs did have an explosive burster).

1.3.2.2 Dunn Field, Site #1 (Area B), measures approximately 200 feet wide by 1200 feet long and approximately 5-1/2 acres. In 1952/1953 and again in 1955/1956, Chemical Agent Identification Kits were buried (kit type unknown).

2.0 **OBJECTIVES.**

2.1 The objectives of this task order include:

2.1.1 To determine if CWM, OE, degradation products, or decontamination constituents are present and are migrating from the burial sites.

2.1.2 To characterize the extent and model the volume of CWM/OE contamination in order to assess and recommend removal action.

2.1.3 To develop a removal action plan that satisfies the EPA, State, Federal Government, and public concerns.

2.1.4 To provide location specific clearances for units within the suspect areas in order to facilitate progression of RI/FS investigations.

2.1.5 To prepare a risk assessment for the site.

2.1.6 To devise and compare feasible alternate actions including a no action alternative.

2.1.7 To prepare an Engineering Evaluation/Cost Analysis (EE/CA) report that recommends and justifies appropriate preferred Ordnance and Explosive (OE) Removal Alternatives.

2.2 Areas To Be Evaluated. The A-E shall review and evaluate existing documentation and aerial photographs specific to the sites proposed for investigation. The A-E shall clearly identify the limits of the associated sites for investigation and document the rationale for these decisions in the Work Plan.

3.0 TASKS

3.1 TASK 1 - PREPARE WORK PLAN (WP). The A-E shall prepare and submit a Work Plan for Government review and approval. The Work Plan shall describe in detail the site background and history, investigation objectives, all proposed investigative activities, monitoring, equipment, procedures, personnel, and schedule. No Work Plan will take precedence over the requirements detailed in this Scope of Work. The A-E shall conduct a records review of pertinent information regarding the Dunn Field Area (Ref 9.34 to 9.44). A site visit is authorized to assist in the preparation of the Work Plan. The site visit team shall not exceed three persons and shall include one Senior UXO Supervisor. The site visit shall be coordinated with the Contracting Officer (CO) and DDMT at least 10 days prior to arriving on site. An abbreviated Site Safety and Health Plan (ASSHP) shall be prepared by the A-E and submitted to the CO for review and approval prior to the site visit. The A-E shall ensure that the site visit is fully coordinated and that all members of the site visit team maintain compliance with the ASSHP. A sample ASSHP may be obtained from the CEHNC Safety Office. The Work Plan shall include the following sub-plans and Standard Operating Procedures (SOPs).

3.1.1 Health and Safety Program (HSP). The A-E shall develop and maintain a Health and Safety Program in compliance with the requirements of OSHA standard 29 CFR 1910.120(b)(1) through (b)(4). Written certification that the HSP has been developed and implemented shall be submitted to the Contracting Officer and the plans shall be made available upon request. The A-E shall develop a Site Safety and Health Plan (SSHP) in accordance with (IAW) the requirements of Section 5.0 of this SOW. The SSHP shall be submitted to the Contracting Officer for review and approval prior to any of the field work described in this SOW. All work shall be performed IAW the approved plan.

3.1.2 Generic Quality Assurance Project Plan. The A-E shall reference the "Defense Depot Memphis Tennessee Generic Quality Assurance Project Plan (QAPP)" in preparation of the Site Specific Geophysical Investigation Plan; the Site Specific Chemical Data, Laboratory and Field Work Plan(s); and the Site Specific Investigative Derived Waste (IDW) Plan. The plans shall be consistent with the procedures outlined in the QAPP when applicable to the work being performed. However, when specific requirements for performing CWM/OE related tasks conflict with the QAPP, specific requirements shall govern.

3.1.2.1 Site Specific Geophysical Investigation Plan. The purpose of the geophysical investigation plan is for the A-E to propose methods to ensure that OE and CWM suspected anomalies are identified and avoided during intrusive activities. The A-E shall describe the methods, equipment, locations, quality control, and quantities of geophysical investigations proposed for use during field investigations. The plan shall document the reasons behind the selection of the equipment and methods to be used. The A-E shall ensure that the equipment selected to perform the geophysical investigations for this task order is capable of providing the desired results in the environment and soil conditions found at DDMT.

3.1.2.2 Site Specific Chemical Data, Laboratory and Field Work Plan(s). The A-E shall describe the locations and quantities of subsurface soil samples, surface soil, sediment, ground water, and surface water samples (if applicable), and sampling tools, and the analytical methods and equipment to be used. This plan shall also include the number of samples of each matrix to be taken, the specific chemical parameters to be analyzed for chemical warfare materiel constituents, chemical warfare materiel degradation product analysis, and the number of analyses to be performed. The plan shall describe field investigation and decontamination procedures applicable to both CWM and HTW field sampling. ERDEC laboratory certification for CWM analysis procedures are required. Additional requirements are identified in paragraph 6.0.

3.1.2.3 Site Specific Investigative Derived Waste (IDW) Plan. The A-E shall coordinate with DDMT and describe how IDW shall be handled at the site. Disposal requirements for CWM and hazardous waste must be defined. The handling, containerization, treatment(if applicable), and disposal procedures shall be specified prior to generating any IDW. The plan shall describe if the waste must be containerized; type of containerization method; disposal sampling and analytical strategy to be utilized; acceptable disposal facilities; site storage and security; treatment(if applicable); transportation; manifesting; and storage time limits at a minimum. CEHNC approval of the IDW procedures shall be obtained in writing prior to A-E field mobilization.

3.1.3 Work, Data, and Cost Management Plan (WDCMP). The appended WDCMP shall contain a schedule for the accomplishment of the tasks described in this SOW. The WDCMP shall also modify, if required, the organization structure; the assignment of functions, duties and responsibilities; and the functional relationships among all organizational elements (both Government and A-E) that will participate in the accomplishment of the tasks.

3.1.4 Environmental Protection Plan (EPP). The A-E shall prepare a brief Environmental Protection Plan which describes field activities to be performed and potentially impacted flora, fauna, archeological resources, wetlands, or other valuable environmental resources as a result of the investigation process. The EPP shall describe steps required for preventive measures or mitigative measures necessary as a result of potential impact to environmental resources by the actions in Dunn Field.

3.2 TASK 2 - PERFORM SITE CHARACTERIZATION.

3.2.1 Geophysical Survey. Geophysical Investigations will be a major part of the Site Characterization for this project. The geophysical investigations shall be managed by a qualified geophysicist (i.e., an individual with a degree in geophysics, geology, geological engineering, or closely related field, and who has a minimum of 5 years of directly related geophysical experience). It is the responsibility of the A-E to insure that the appropriate geophysical methods and equipment are applied to investigate and discriminate anomalies. Field instrumentation shall be field tested daily to ensure that it is operating properly. If an instrument does not meet the standard during the daily check, it shall be recalibrated, repaired or replaced.

3.2.2 Surface Soil Samples. The A-E shall obtain surface soil and sediment samples from the top 6 inches at selected sites in the approved Work Plan which could potentially have been contaminated with CWM or decontamination products. Each sample shall be divided into a minimum of two sub-samples. One sub-sample shall be used to take off-gas head space readings to insure CWM is not present in the sample. Another sub-sample shall be analyzed for CWM/OE and constituents/degradation products. Additional locations may be sampled with adequate justification and Government approval.

3.2.3 Soil Borings. The A-E shall drill soil borings to gather necessary data to complete the objectives for the areas of concern. Soil borings shall not exceed forty (40) feet in depth unless they are to be converted to monitoring wells or with Government approval. The A-E will obtain soil samples at two foot intervals. Soil samples shall be field screened for CWM and CWM degradation products. A minimum of two (2) or a maximum of six (6) samples shall be field selected from each boring for laboratory analysis. The termination sample from each boring shall be included in the samples selected for laboratory analysis. The A-E shall use appropriate geophysical methods, to locate the borings in the field at an appropriate distance from any geophysical anomalies. Down hole geophysical methods shall be used to advance the sampling tool. The Government assumes that the driller will not advance the boring more than two feet without using down hole geophysical methods to check for additional anomalies. The number, depth, and location of soil borings shall be proposed in the Work Plan for Government approval. Subsurface sampling points shall be located to the nearest one foot (1.0 ft) horizontally and to the nearest one-tenth of a foot (0.1 foot) vertically.

3.2.4 Monitoring Wells. There are approximately 21 monitoring wells (within the upper aquifer) in Dunn Field. Monitoring well depths range from 60 feet at MW-29 in the north to 210 feet at MW-36 in the southeast corner of Dunn Field. Existing monitoring wells shall be utilized when possible. Monitoring wells shall be installed in and around OU-1, unnumbered site, and OU-1, Site #1 (Area A and Area B) in the uppermost aquifer, but not greater than a eighty (80) foot depth without prior government approval. At least one up-gradient well shall be installed at each site, as well as sufficient down-gradient and side gradient wells to establish whether contaminants are migrating in the groundwater. The A-E shall use appropriate geophysical methods to locate the monitoring wells in the field an appropriate distance from any geophysical anomalies. The number, depth, and location of wells shall be proposed in the Work Plan. The A-E shall convert borings used to collect soil samples to monitoring wells if needed and when feasible. Following installation and development, each well shall be sampled for subsequent analysis.

3.2.5 Chemical Analysis of Samples. Ground water and soil samples shall be screened in the field for the presence of CWM. CBDCOM will take one of the sub-samples taken at each sampling location to conduct a head space test. If agent is not detected the other sub-samples may be sent to the approved laboratory. Samples field identified as containing CWM shall be immediately handled as described in the approved work plan. The samples shall be subdivided for 1) CBDCOM head space and 2) ERDEC certified laboratory chemical materiel analysis. The A-E shall notify the laboratory in writing that the samples may contain CWM.

3.2.5.1 Samples collected shall be analyzed in the laboratory for CWM, CWM degradation products (Reference 9.5), OE, OE degradation products and such other analytical parameters as the A-E shall propose in the Work Plan and approved by the contracting officer. A minimum of two sub-samples shall be taken at each proposed sample location or depth. One sub-sample shall be used to take off-gas head space readings to insure CWM is not present in the sample. Another sub-sample shall be analyzed for

CWM/OE and constituents/degradation products. Additional samples as identified and approved in the work plan shall be collected for quality control analysis.

3.2.5.2 Health based exposure standards of the constituents of CWM/OE and degradation products shall be used if compound specific standards are unavailable. If health based standards are not available, then land disposal contaminant level restrictions shall be applied to defining the extent of contamination.

3.3 TASK 3 - LETTER REPORTS.

3.3.1 Analytical Letter Report. The A-E shall submit a letter report with the analytical results as soon as they become available. This report shall identify sample identification, sampling location and depth and provide the analytical results. The A-E's opinion of the data's completeness, accuracy, and possible contamination trends should be presented.

3.3.2 IDW Letter Report. A separate letter report for IDW shall identify, at a minimum, the container identification number, the location and total number of containers in each area and site wide, the number of samples obtained to fully characterize the containers, the analytical methods run, the analysis obtained, and proposed disposal options and cost. A preferred alternative for IDW disposal shall be provided which includes, at a minimum, the proposed disposal location(s), associated treatment, time frame associated with storage, removal and treatment, regulatory impacts, and cost.

3.3.3 Geophysical Report of Field Data. Field report(s) shall be provided that contains the geophysical digital data that is transferrable to CEHNC electronically.

3.4 TASK 4 - IDW DISPOSAL. The A-E shall, if directed by the Contracting Officer, dispose of the bulk and or containerized IDW (i.e. CWM, hazardous and toxic waste, drill cuttings, development water, purge water, decontamination wastes etc.). The containers shall be located, secured, labeled, sampled and analyzed in accordance with the approved work plan. After receipt of the letter report recommending appropriate disposal actions, the Contracting Officer shall direct the A-E in the disposal of IDW. The A-E shall perform the IDW disposal in a timely manner. Cost for the disposal of IDW shall be obtained in writing from a minimum of three independent sources.

3.5 TASK 5 - MEETINGS AND PUBLIC INVOLVEMENT. The A-E shall provide a minimum of two professionals thoroughly familiar with the project, to attend a minimum of five meetings. The A-E shall be prepared to work with the Restoration Advisory Board (RAB) composed of local citizens who will advise the State and Federal agencies of their concern. Provide, in your cost proposal, the cost per meeting. Assume four one day meetings will be held at or close to DDMT, and one meeting will be held at Huntsville Center. The A-E shall be prepared to show overheads or use other presentation techniques to convey to the RAB your plans, findings and recommendations.

3.6 TASK 6 - RECORD AND SUBMIT VIDEO TAPE.

3.6.1 The A-E shall furnish the necessary personnel and equipment to video tape a sample of each activity from all field tasks of this SOW. Taping shall be of typical activities and accurately depict all work accomplished.

3.6.2 The A-E shall also provide tapes of the RAB proceedings.

3.6.3 The video tape shall be standard VHS ½-inch color tape with voice background describing the actions being filmed, containing a maximum of 120 minutes footage.

3.6.4 Two copies of the video tape shall be submitted as part of the Engineering Report.

3.7 <u>TASK 7 - PROJECT MANAGEMENT</u>. The A-E shall, during the life of the Task Order, manage the Task Order to accomplish the Statement of Work Appendix A. All project management associated with this Task Order, with the exception of direct technical oversight of work described in the preceding tasks, shall be accounted for in this task. As part of this task, the A-E shall prepare and submit Work Task Proposals that outlines the manner in which the A-E intends to accomplish each task in this SOW. The Work Task Proposals shall include scope or level of effort required for the task, milestones, expected completion dates, and any other planning data the A-E will use to accomplish each task.

3.8 <u>TASK 8 - LOCATION SURVEYS AND MAPPING</u>.

3.8.1 UXO Safety. During all field and intrusive activities, the survey crew shall be accompanied by an EOD specialist who shall conduct visual Unexploded Ordnance (UXO) surveys for surface ordnance prior to the survey crew entering a suspect area, and a magnetometer survey for each intrusive activity site to ensure that the site is anomaly free prior to the survey crew setting monuments, driving stakes, or establishing other points. Based on site conditions, it is possible that an EOD escort will not be required in all areas at all times after the initial site visit. However, such a decision will be made jointly by the on-site Safety Officer and the CEHNC Safety Specialist who may rescind or modify the decision at any time.

3.8.2 All of the location survey and mapping to be provided by this Task Order shall be conducted and/or supervised by a Registered or Professional Land Surveyor (RLS/PLS) registered and licensed by the State Board of Registration for Professional Engineers and Land Surveyors in the State of Tennessee. All maps and drawings to be provided by this SOW shall be sealed and signed by the RLS/PLS.

3.8.3 Control Points. All of the control points (monuments) recovered and/or established at the site shall be plotted at the appropriate coordinate point on a planimetric map(s) and to be provided by the Government. Each control point shall be identified by name or number and include the final adjusted coordinates and the final adjusted elevations. A tabulated list and a "description card" of all control points established or used shall be submitted with the final engineering report. Each description card shall show a sketch of each monument; its location relative to reference marks, buildings, roads, towers, etc.; a typed description telling how to locate the monument from a well known and easily recognizable point; the monuments name or number; and, the final adjusted coordinates and elevations.

3.8.4 Location Surveys. Coordinates and elevations shall be established for each soil boring, monitoring well, and the corners of each sampling pit dug for this project. The coordinates shall be to the closest one foot and referenced to the Tennessee state plane coordinate system and the North American Datum of 1983 (NAD83). Elevations to the closest 0.1 foot shall be established for the ground surface elevation for each soil boring and to the closest one-hundredth of a foot (0.01 ft) for the survey marker in the concrete pad protecting each well and for the top of casing of each monitoring well. These elevations shall be referenced to the North American Vertical Datum of 1988 (NAVD88). Reference paragraph 6.0 of the Generic Quality Assurance Project Plan for further guidance.

3.8.5 Mapping. The location, identification, coordinates and elevations of the monuments, soil borings, monitoring wells, geographical investigation points, and sampling pits shall be plotted on a reproducible (Mylar) planimetric map at a scale no smaller than one inch equals 100 hundred feet (1 inch = 100 feet) to show their location with reference to all the surface and physical features within the project area.

3.8.6 Items and data to be submitted to CEHNC are as follows:

3.8.6.1 Field Survey. Copies of all field books, layout sheets, computation sheets, abstracts, and computer printouts. All of these items shall be suitably bound, and clearly marked and identified.

3.8.6.2 A tabulated list of all control points showing the adjusted coordinates and elevations (to the closest one-hundredth of a foot) established and/or used for this survey.

3.8.6.3 A tabulated list of all soil borings, monitoring wells, sampling points, and sampling pits showing their coordinates to the closest 1.0 foot and all the required elevations.

3.8.6.4 A "Report of Establishment of Survey Mark" (Description Card) on each permanent control monument established and/or used for the survey. In addition to the name or I.D. number of the monument, the cards should show the adjusted coordinates and the adjusted elevations (to the closest 0.01 foot), a written description for locating the monument from a well known and easily identifiable point, and a sketch showing how to locate the monument.

3.8.6.5 Drawings. All maps shall be drawn at a scale no smaller than one inch = 100 feet on reproducible (Mylar) drawings. One original copy and four blueline prints of each final drawing shall be delivered to CEHNC.

3.9 TASK 9 - PERFORM RISK ASSESSMENT. The A-E shall complete an evaluation of site risks using results from the EPA Risk Assessment Guidance for Superfund (RAGS) (Ref 9.34). RAGS evaluates chronic human health and ecological risk attributable to exposure to chemicals released into the environment. RAGS results defining risks resulting from chemical contamination created by release of CWM constituents into the environment shall be determined by the A-E. Results of RAGS shall be integrated into a combined discussion of overall site risks included in the EE/CA Report.

3.10 TASK - 10 - PREPARE EE/CA REPORT.

3.10.1 The A-E shall prepare and submit an EE/CA report fully documenting the field work and subsequent evaluations and recommendations made by the A-E. The EE/CA Report shall describe the site history, briefly describe previous work conducted at DDMT, the work conducted under this task order, and the results. The report shall also contain the A-E's conclusions as to the nature and extent of CWM contamination at the site, and recommendations for future work at the site. It is the Government's intent to pursue and to address any CWM contamination which may be present. The site should be sufficiently characterized to support an Engineering Evaluation/ Cost Analysis (EE/CA). The textual portions of the report shall be fully supported with accompanying maps, charts, and tables as necessary to fully describe and document all work performed and all conclusions and recommendations presented. After the site investigation is complete and the baseline site risk is assessed, the A-E shall identify and analyze removal alternatives. The A-E shall evaluate the risk that the site represents to human health and the environment. The risk evaluated shall consider chronic health effects which could result from chemical warfare constituents. After the site investigation is complete and the baseline site risk is assessed the A-E shall identify and analyze removal alternatives.

3.10.2 Evaluate Institutional Controls. The EE/CA report shall fully evaluate institutional controls. The A-E shall prepare an institutional analysis to support the development of institutional control alternative plans of action. Institutional controls rely on the existing powers and authorities of the Government agencies to protect the public at large from OE risks. Instead of direct elimination of the OE from the site, these plans rely on behavior modification, and access control strategies to reduce or eliminate OE risk. The objective of this report is to document the Government agencies which have jurisdiction over the OE contaminated lands and to assess their capability and willingness to assert control which could protect the public at large from OE hazards. Additionally this report should document the obligation of Government to protect citizens at large from safety hazards under tort law.

3.10.2.1 Institutional Data Survey Forms. Basic data for the institutional analysis will be collected on forms to be provided by the Government. These forms may be reproduced locally. This data will be collected by a professional Urban Planner or equivalent through telephone and personal contacts. This data will be safeguarded and protected from unofficial use.

3.10.2.2 Institutional Summaries. For each institution selected for review, the following information will be provided:

- Name of Agency
- Origin of Institution
- Basis of Authority
- Geographic Jurisdiction
- Public Safety Function
- Land Use Control Function
- Financial Capability
- Constraints to Institutional Effectiveness (OE Safety)

3.10.2.3 Institutional Analysis Report. The basic report will follow this outline and shall be contained in the EE/CA report as an appendix:

- o Purpose of Study
- o Methodology
- o Scope of Effort/Selection Criteria
- o Acceptance of Joint Responsibility
- o Technical Capability
- o Intergovernmental Relationships
- o Stability
- o Funding Sources
- o Recommendations

3.10.2.4 Alternatives Development. A full range of alternative plans to address project objectives must be developed in the EE/CA report. Screening of alternatives will produce a manageable set of plans which address the concerns of the community, regulators and the DoD. Alternatives should be distinct, feasible and fully developed. All plans that make the draft report must be developed to the same level of detail. Infeasible plans will be discarded during the screening process. A minimum of five alternative plans shall be developed:

- o One alternative shall emphasize the basic strategy of access control.
- o One alternative shall emphasize the basic strategy of physical removal.
- o One alternative shall emphasize the basic strategy of behavior modification.
- o One alternative shall combine all strategies.
- o One alternative shall be the no action.

Several alternatives that address a single strategy may be developed if there are significant differences in plan performance with respect to selection criteria and it is pertinent to the decision process. Only the best of unique strategies will be combined.

3.10.2.5 Institutional Control Alternatives. These alternatives will be based on the opportunities to satisfy project objectives discovered while executing institutional analysis.

Access control alternatives will formulate plans based on concepts such as:

- o Direct intervention like fencing and other barriers combined with trespass law enforcement
- o Land use restrictions (zoning laws and enforcement)
- o Regulatory control (permit application, review, or approval of development plans)
- o Passive measures such as dedication of property to appropriate land uses.

Behavior modification alternatives will formulate plans based on concepts such as:

- o Notification of real estate defect
- o Notices attached to building and/or construction permits
- o Training clinics etc.

These alternatives must be completely formulated. All management, execution, and support roles will be identified. All costs to all participating institutions will be estimated.

3.10.3 Recommendations. In close consultation with the Contracting Officer, the A-E shall recommend a preferred alternative. This EE/CA report shall be prepared in accordance with the guidance contained in "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA" and the outline presented in Table 2 of this SOW.

3.11 TASK 11 - PREPARE ACTION MEMORANDUM. The EE/CA will be provided to the public for their review and comments. The A-E shall evaluate any comments provided by the Contracting Officer from the public and shall incorporate them where directed by the Contracting Officer. Afterwards, the A-E shall prepare an Action Memorandum describing the selected alternative.

3.12 TASK - 12 SCHEDULE. All work and services under this paragraph shall be completed and submitted to CEHNC within 30 days after the completion of all field work.

4.0 SCHEDULE OF MEETINGS AND DELIVERABLES

Task	Days after NTP
Draft Work Plan	14 Nov 97
Final Work Plan	30 Dec 97
Progress/Meeting Report	10 days after event
Mobilization	21 Jan 98
Demobilization	27 Feb 98
Status Report	monthly
Telephone/Conversation Report	monthly
Draft EE/CA Report	15 May 98
Draft Final EE/CA Report	15 Jun 98
Final EE/CA Report	3 Jul 98
Action Memorandum Draft	16 Jul 98
Action Memorandum Final	1 Aug 98

The overall completion date of this Task Order is 30 November 1998.

ADDRESSEE	COPIES
U.S. Army Engineering and Support Center, Huntsville ATTN: CEHNC-OE-CM (Mr. C. Twing) 4820 University Square Huntsville, AL 35805-1957	5

U.S. Army Engineer District, Mobile 4
ATTN: CESAM-PM-TA (Kurt Braun)
P.O. Box 2288
Mobile, AL 36628-0001

Commander 2
Technical Escort Unit
ATTN: SMCTE-OP
Aberdeen Proving Grounds, MD 21010

Project Manager for Non-Stockpile 2
Chemical Materiel
ATTN: SFIL-NSP
Aberdeen Proving Grounds, MD 21010-5401

Defense Logistics Agency 4
Defense Distribution Depot Memphis
ATTN: DDMT-DE (Mr. Glenn Kaden)
2163 Airways Blvd.
Memphis, TN 38114-5210

Defense Logistics Agency 1
ATTN: DLA-WS
Alexandria, VA 22303-6100

USEPA Region IV 2
ATTN: Mr. Dann Spariosu
100 Alabama St. SW
Atlanta, GA 30303

Defense Distribution Region East 1
ATTN: ASCE-WP (Mr. Mike Dobbs)
Bldg. 1-1, 2nd Floor
New Cumberland, PA 17070-5001

Defense Logistics Agency 1
ATTN: Ms. Karen Moran
8725 John J. Kingman Road
Suite 2533
Ft. Belvoir, VA 22060-6219

4.1 Format and Content of Engineering Report. All drawings shall be of engineering quality with sufficient details. The report shall consist of 8 ½" X 11" paper. The report covers shall consist of durable binders and shall hold pages firmly while allowing easy removal, addition, or replacement of pages. A title shall identify the installation and site, the A-E, the

Huntsville Center, and date. The A-E identification shall not dominate the title page. All data, including raw analytical and electronic data, generated under this task order are the property of the DoD and the Government has unlimited rights regarding its use.

4.2 Review Comments. The A-E shall review all comments received through the CEHNC Project Manager and evaluate their appropriateness based upon their merit. The A-E shall incorporate all applicable comments and provide a written response to each comment no later than 21 days after the A-E receives the comment.

4.3 Identification of Responsible Personnel. Each submittal shall identify the specific members and title of the subcontractor and A-E's staff which had significant input into the report. All final submittal shall be sealed by the State of Tennessee registered Professional Engineer-In-Charge.

4.4 Presentations. The A-E shall make presentations of work performed according as directed by the Contracting Officer. The presentation shall consist of a summary of the work accomplished and will be followed by an open discussion.

4.5 Minutes of Meetings. Following the presentation and the public meeting, the A-E shall prepare and submit minutes of the meeting within 10 working days to the Contracting Officer.

4.6 Correspondence. The A-E shall keep a record of phone conversation and written correspondence affecting decisions relating to the performance of this task order. A summary of the phone conversations and copies of written correspondence shall be submitted to the Contracting Officer with the monthly progress report.

4.7 Monthly Progress Report. The A-E shall prepare and submit monthly progress reports describing the work performed since the previous report, work currently underway and work anticipated. The report shall state whether current work is on schedule. If the work is not on schedule, the A-E shall state what actions are taken in order to get back on schedule. The report shall be submitted to the Contracting Officer not later than the 10th day of each calendar month.

4.8 Computer Files. All final text files generated by the A-E under this task order shall be furnished to the Contracting Officer in WordPerfect 6.0, IBM PC compatible format. All drawings shall be on reproducible (Mylar) and digitized 3D design file in Intergraph Corporation format, compatible with CEHNC Graphics system.

5.0 **SAFETY REQUIREMENTS**

5.0.1 The A-E shall prepare and submit a Site-Specific Safety and Health Plan (SSHP) to the Contracting Officer for review and approval prior to commencement of any field work. The SSHP shall be prepared in accordance with the requirements specified in this section and shall comply with all federal, state and local health and safety requirements, e.g., the Occupational Safety and Health Administration (OSHA) requirements (29 CFR 1910 and 1926), the U.S. Environmental Protection Agency (USEPA) hazardous waste requirements (40 CFR 260-270), and the U.S. Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1) and the U.S. Army Corps of Engineers Safety and Occupational Health Document Requirements for HTRW and OE Activities (ER 385-1-92), dated 18 March 1994, and applicable Army regulations. The contractor shall submit versions of this document in accordance with the schedule provided in this SOW. The contractor shall revise and re-submit this document as necessary to address all comments and deficiencies.

5.0.2 The SSHP shall address the elements as described in this section. The level of detail provided shall be tailored to the type of work, complexity of operations to be accomplished and the hazards anticipated. Where a specific element is not applicable, make negative declaration in the plan to establish that adequate consideration was given the topic and provide a brief justification for its omission.

5.1 General. The SSHP shall be reviewed, approved and implemented by a board certified or board eligible Industrial Hygienist with at least 2 years hazardous waste site operations experience. Board certification or eligibility shall be documented by written confirmation by the American Board of Industrial Hygiene (ABIH) and submitted to the Contracting Officer for review. A fully trained and experienced site safety and health officer (SSHO) (a UXO Supervisor at minimum) responsible to the A-E shall be delegated to implement the on-site elements of the SSHP. The SSHP shall be in a form usable by authorized U.S. Government representatives and other authorized visitors to the site during site operations.

5.2 Staff Organization, Qualifications and Responsibilities. The operational, health, and safety responsibilities of each key person shall be provided. The organizational structure, with lines of authority and overall responsibilities for safety and health of the A-E and all subcontractors shall be discussed. An organizational chart showing the lines of authority for safety shall be provided. Each person assigned specific safety and health responsibilities shall be identified and his/her qualifications and experience documented by a resume in the SSHP.

5.3 Site Description and Contamination Characterization. Provide a description of the site based on results of previous studies, site history and prior site uses and activities. Describe the location topography and approximate site of the site, the on-site job tasks to be performed and the duration of planned activities. Compile a summary of hazardous substances and safety and health hazards likely to be encountered on site. Include ordnance and chemical/biological names, concentration ranges, media in which found, locations on-site and estimated quantities/volumes to be impacted by site work. The site descriptions shall be based on results of previous studies, and the history of prior site uses and activities conducted under Task 1 of this Scope of Work.

5.4 Hazard Assessment and Risk Analysis. In the SSHP, the A-E shall provide a complete description of the work to be performed at each site. The A-E shall identify the chemical, physical, safety and biological hazards that may be encountered for each task and/or site operation to be performed. Each task/operation is to be discussed separately. Routes and sources of exposure for chemical hazards anticipated on-site along with chemical/biological names, concentration ranges, media in which found, locations on-site, estimated quantities/volumes, and the applicable regulatory standards (PELs) and recommended protective exposure levels (TLVs) shall be provided. Action levels shall be specified and justified for implementation of engineering controls/and or work practice controls, for emergency evacuation of on-site personnel, and for the prevention and/or minimization of public exposure to hazards created by on-site activities.

5.5 Accident Prevention. The SSHP may serve as the Accident Prevention plan provided it addresses all content requirements of both 29 CFR 1910.120 and EM 385-1-1, Appendix A. All Accident Prevention Plan elements required by EM 385-1-1, but not specifically covered by these elements, shall be addressed in this section of the SSHP. Daily safety and health inspections shall be conducted to determine if site operations are conducted in accordance with the approved plans and contract requirements.

5.6 Training. All general site workers shall receive 40 hours of initial off-site health and safety training (24 hours for non-exposed on-site personnel) which is relevant to hazardous waste site activities, plus three days of supervised field experience (one day for non-exposed personnel), in compliance with 29 CFR 1910.120(e). In addition, site-specific, supervisory, refresher and visitor training and training in accordance with the aforementioned regulation and training in accordance with DA PAM 385-61 shall be addressed. The content, duration and frequency of all training shall be described. The contractor shall provide written certification that the required training has been received by the contractor's affected personnel to the Contracting Officer prior to engaging in on-site activities.

5.7 Personal Protective Equipment. A written Personal Protective Equipment (PPE) Program shall be provided in the SSHP. The program shall address all the elements of 29 CFR 1910.120 (g)(5), 29 CFR 1910.132, and 29 CFR 1910.134. Minimum levels of protection necessary for each task/operation to be performed at each site based on probable site conditions, potential occupational exposure (including heat and cold stress) and the hazard assessment/risk analysis required above. Include specific types and materials for protective clothing and respiratory protection. Establish and justify upgrade/downgrade criteria based upon the action levels established. As a minimum and as appropriate the following emergency and first aid equipment shall be immediately available for on-site use: (1) First aid equipment and supplies approved by the consulting physician; (2) Emergency eye washes/showers which comply with ANSI Z-358.1; (3) Emergency use respirators (worst case appropriate); (4) Spill control materials and equipment and (5) Fire extinguishers (specify type, size, and locations).

5.8 Medical Surveillance. All personnel performing on-site activities shall participate in an ongoing medical surveillance program meeting the requirements of 29 CFR 1910.120, ANSI Z-88.2 and DA Pam 40-173, as applicable. The medical examination protocols and results shall be overseen by a licensed physician who is certified in Occupational Medicine by the American Board of Preventive Medicine, or who by necessary training and experience is board eligible. Minimum specific exam content and frequency based on probable site conditions, potential occupational exposures and required protective equipment shall be specified. A written medical opinion from the examining physician as to fitness to perform the required work shall be made available to the CO upon request for any site employee.

5.9 Environmental and Personal Monitoring. Where it has been determined that there may be employee exposures to and/or off site migration potentials of hazardous airborne concentrations of hazardous substances, appropriate direct reading (real-time) air monitoring and integrated (time weighted average) air sampling shall be conducted in accordance with applicable federal, state and local requirements. Both air monitoring and air sampling must accurately represent concentration of air contaminants encountered on and leaving the site. The types and frequency of monitoring/sampling to be performed shall be specified for on-site and perimeter, where applicable. Where perimeter monitoring is not deemed necessary, provide suitable justification for its exclusion. When applicable, NIOSH and/or EPA sampling and analytical methods shall be used. Personal samples, where necessary, shall be analyzed by laboratories successfully participation in and meeting the requirements of the American Industrial Hygiene Association's (AIHA) Proficiency Analytical Testing (PAT)or laboratory Accreditation Program. Include, as appropriate, real-time (direct-read) monitoring and integrated Time Weighted Average (TWA) sampling for specific contaminants of concern, meteorological, noise and radiation monitoring shall be conducted as needed depending upon the site hazard assessment. All monitoring and sampling protocol shall be specified to include instrumentation to be used and calibration of instruments. All monitoring results shall be compared to action levels to determine the need for corrective actions. CWM monitoring shall use CBDCOM protocols. Action levels will be in accordance with AR 385-61 and DA PAM 385-61. The A-E shall coordinate with CBDCOM through CEHNC.

5.10 Heat/Cold Stress Monitoring. Heat and cold stress monitoring protocols, as appropriate, shall be described in detail. Work/rest schedules shall be determined based upon ambient temperature, humidity, wind speed (wind chill), solar radiation intensity, duration and intensity of work and protective equipment ensembles. Minimum required physiological monitoring protocols which will affect work schedules shall be developed. In cases where impervious clothing is worn the NIOSH/OSHA/USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" protocol for prevention of heat stress shall be followed and heat stress monitoring shall commence at temperatures of 70 degrees Fahrenheit and above. Where impervious clothing is not worn, the ACGIH heat stress standard (TLV) shall be used. For cold stress monitoring to help prevent frostbite and hypothermia, the ACGIH cold stress standard shall be referenced and followed, as a minimum.

5.11 Site Control. The A-E shall describe site control measures which include site maps, the work zone delineation and access points, the on/off site communication system, general site access controls and security procedures (physical and procedural).

5.12 Personnel and Equipment Decontamination. The A-E shall develop and specify decontamination procedures in accordance with 29 CFR 1910.120, AR 385-61 and DA PAM 385-61 for personnel, personal protective equipment, monitoring instruments, sampling equipment, and heavy equipment. Decontamination procedures shall address specific measures to ensure that contamination is confined to the work site. Necessary facilities and their locations, detailed standard operating procedures, frequencies, supplies and materials to accomplish decontamination of site personnel and to determine adequacy of equipment decontamination shall be discussed.

5.13 Emergency Response and Contingency Procedures (On-site and Off-site). An Emergency Response Plan as required by 29 CFR 1910.120 and DA PAM 50-6 shall be developed and implemented. As a minimum it shall address the following elements: (1) Pre-emergency planning and procedures for reporting incidents to appropriate government agencies for potential chemical exposure, personal injuries, fire/explosions, environmental spills and releases, discovery of radioactive materials; (2) Personnel roles, lines of authority, communications; (3) Posted instructions and list of emergency contacts: physician, nearby notified medical facility, fire and police departments, ambulance service, state/local/federal environmental agencies, CIH, and Contracting Officer; (4) Emergency recognition and prevention; (5) Site topography, layout and prevailing weather conditions; (6) Criteria and procedures for site evacuation (emergency alerting procedures/employee alarm system, emergency PPE and equipment, safe distance, place of refuge, evacuation routes, site security and control; (7) specific procedures for decontamination and medical treatment of injured personnel; (8) Route maps to nearest pre-notified medical facility; (9) Criteria for initiating community alert program, contacts and responsibilities; and (10) Critique of emergency responses and follow-up. Material Safety Data Sheets (MSDS) for each hazardous substances anticipated to be encountered on site shall be made accessible to site personnel at all times and shall be submitted in an appendix to the SSHP.

5.14 Standing Operating Procedures, Engineering Controls and Work Practices. The A-E shall develop Standing Operating Procedures to protect field personnel, prevent accidents, minimize hazards and to take action to correct hazards where necessary. Site rules and prohibitions for safe work practices shall be discussed and shall include such topics as use of the buddy system, smoking restrictions, material handling procedures, confined space entry, excavation safety, physiological and meteorological monitoring for heat/cold stress, illumination, sanitation, and daily safety inspections, etc. This list of topics is not intended to be all inclusive.

5.15 Logs, Reports and Record Keeping. Record keeping procedures for training logs, daily safety inspection logs, employee/visitor registers, medical surveillance records and certifications, air monitoring results and personal exposure records shall be specified. All personnel exposure and medical monitoring records shall be maintained in accordance with applicable OSHA standards, CFR 1904, 1910 and 1926. The A-E shall develop, retain and submit training logs, daily safety inspection logs as part of the daily QC Reports, employee/visitor registration and medical opinions/certifications as part of the final contract file. All recordable accidents/injuries/ illnesses shall be reported to the CO immediately. A completed

ENG 3394, Accident Investigation Report, shall be submitted within two working days in accordance with AR 385-40 and USACE Supplement 1 to that regulation.

5.16 Explosive Ordnance. The facility is a military installation. If known or potential ordnance, explosives, or chemical warfare materials contamination are discovered at any time during operations at the site, the A-E shall mark the location, immediately stop operations in the affected area, proceed upwind, and notify the COE on-site Safety specialist or CEHNC safety office. If not available, the Contracting Officer shall be notified. The A-E shall have on-site capability to evaluate any OE encountered. Suspect CWM filled OE shall immediately become the responsibility of the on site TEU/ERDEC team acting as the initial response force. It is the express intention of the Government that the A-E is not to drill, excavate, or otherwise physically disturb the subsurface directly where ordnance, chemical agent or explosives may reasonably be suspected to be encountered. The A-E's SSHP shall specifically include the topics addressed in this paragraph.

6.0 CHEMICAL DATA AND LABORATORY REQUIREMENTS

6.1 Quality Assurance Project Plan (QAPP). The A-E shall prepare the QAPP. The QAPP shall describe the sampling and analyses, quality assurance and quality control methods, equipment, evaluations, reports and procedures as required for the work specified in this SOW. The plan shall describe field and laboratory procedures. The plan shall clearly describe how the A-E shall ensure that sample integrity and chain of custody of all samples are not compromised prior to delivery to the laboratory, and should describe the procedures which will be used to document and report precision, accuracy and completeness of data results. The plan shall be a brief and concise description of the field and laboratory work required. Previously prepared work plans for similar type of work shall be utilized as much as possible in the preparation of the plan. The data quality and quality control applies to both the field and laboratory efforts. Results of the field and laboratory controls shall be evaluated and placed in the analytical data submittal, and the draft and final Engineering Reports. The A-E shall provide the laboratory QA/QC plan as an appendix to the QAPP. The plan shall address each requirement as identified in ER 1110-1-263.(Reference 9.8)

6.2 Laboratory Qualifications. The analytical laboratory utilized by the A-E for analysis must be validated or certified by the Corps of Engineers' Missouri River Division (CEMRD) and ERDEC and must have the capability to perform the analytical methods required by this SOW. The laboratory shall be an EPA contract lab or be familiar with the Contract Laboratory Program (CLP) requirements and can perform CLP work.

6.3 Data Reporting Requirements. The A-E shall provide the following data reporting elements: sample ID, sample receipt, organic and inorganic reporting, internal quality control reporting (lab blanks, surrogate spike samples, lab duplicates or matrix spikes) and field duplicates and blanks. Data shall be provided in accordance with USACE requirements and USEPA requirements. These data shall be included in the raw data submittal as well as in electronic form in the engineering reports. The A-E laboratory must hold and make available all project raw data for a period of five years after completion of this contract. The A-E must validate all the data. Complete data validation shall be performed on 10% of the sample analysis packages.

6.3.1 Minimum Raw Data Reporting Requirements:

6.3.1.1 Sample IDs. The A-E shall prepare a tabular presentation which matches contract laboratory sample IDs to QC laboratory sample IDs. This table shall identify all Field Duplicates and Field Blanks (including rinsates and trip blanks) as such. This table shall also match all rinsates with their corresponding field samples as well as matching each trip blank with the samples that accompanied it during shipment.

6.3.1.2 Sample Receipt. The contractor shall complete and report a "Cooler Receipt Form" for all shipments for purposes of noting problems in sample packaging, chain-of-custody, and sample preservation. An example form is available from CEMRD-ED-GL.

6.3.1.3 General Organic and Inorganic Reporting. For each analytical method run, the A-E shall report all analytes for each sample as a detected concentration or as less than the specific limits of quantitation. Generally, all samples with out-of-control spike recoveries being attributed on matrix interferences shall be designated as such. All soil/sediment and solid waste samples shall be reported on a dry-weight basis with percent moisture also reported. The A-E shall also report dilution factors for each sample as well as the date of extraction (if applicable) and date of analysis.

6.3.1.4 Internal Quality Control Reporting (at a minimum, internal quality control samples shall be analyzed at rates specified in the specific methods or as specified in the SOW if higher rates are required to meet project specific Data Quality Objectives):

6.3.1.4.1 Laboratory Blanks (Method Blanks and Instrument Blanks). All analytes shall be reported for each laboratory blank. All non-blank sample results shall be designated as corresponding to a particular laboratory blank in terms of analytical batch processing.

6.3.1.4.2 Surrogate Spike Samples. Surrogate Spike Recoveries shall be reported with all organic method reports where appropriate (i.e. when the method requires surrogate spikes). The report shall also specify the control limits for surrogate spike results as well as the spiking concentration. Any out-of-control recoveries (as defined in the specified method) shall result in the sample being rerun (both sets of data are to be reported) or data being flagged.

6.3.1.4.3 Matrix Spike Samples. Matrix Spike Recoveries shall be reported for all organic and inorganic analyses. All general sample results shall be designated as corresponding to a particular matrix spike sample. The report shall indicate what field sample was spiked even if it was not a Corps of Engineers project sample. The report shall also specify the control limits for matrix spike results for each method for each matrix.

6.3.1.4.4 Laboratory Duplicates and/or Matrix Spike Duplicate Pairs. Relative Percent Difference shall be reported for all duplicate pairs as well as analyte/matrix specific control limits.

6.3.1.4.5 When run for internal quality control, Laboratory Control Standard's (LCS) results shall be reported with the corresponding field sample data. Control limits for LCSs shall also be specified.

6.3.1.5 Field Duplicates and Field Blanks. These samples shall be identified as such by the A-E and reported as any other field sample. Relative Percent Differences shall be reported for all field duplicate pairs.

6.4 Data Quality. The A-E shall provide a data quality level that is compatible with an RI/FS study. The data quality must be sufficient to be utilized in the DDMT site wide RI/FS, Risk Assessment, and Remedial Action Plans that will be prepared by the US Army Corps Of Engineers. The A-E shall provide quality control of the various analytical tasks performed.

7.0 SOIL BORING AND MONITORING WELL INSTALLATION REQUIREMENTS

7.1 General Requirements. All borings and well installations shall be performed in accordance with Chapter 5 of the DDMT Generic QAPP. All borings and well installations shall be overseen by a qualified geologist or geotechnical engineer. Boring logs shall be prepared on 8 ½ by 11 inch sheets, identifying the boring or well number, the location, stratigraphy, soil type according to the Unified Soil Classification System (ASTM D 2487), sampling locations, date begun, date finished, depth to groundwater (both at first encounter and after it has stabilized), or bed rock , elevation of the ground surface at the top of hole (if available), type of drilling equipment and sampling tools, and name of the driller and of the logger. A separate well construction log shall be prepared for each well showing details of the well construction, including screened interval, materials used for casing, screen, sand pack, seal, and grout, dates of starting and completion, and name of the driller and the logger. The A-E shall obtain all necessary permits for boring and well construction. Geologic logs shall be faxed to CEHNC no later than 0800 hrs, central standard time, on the day after the completion of the subsurface sampling event.

7.2 Soil Borings. Soil boring methods shall be chosen to minimize the quantity of IDW. The sampling objectives are to obtain representative analytical samples of each soil layer, minimize cross-contamination between layers, and provide an understanding of site stratigraphy. Detailed geotechnical analysis of soil samples is not required. The specific methods and equipment to be used shall be described in the Work Plan for Government approval. After borings are complete and they are not to be converted into monitoring wells, they shall be abandoned by grouting from the bottom to the top of the boring with Portland cement grout. If allowed by state requirements, 3% by weight of bentonite powder shall be mixed with the cement used for mixing grout.

7.3 Monitoring Wells. Monitoring wells shall be installed to evaluate the groundwater levels across each site and allow for periodic sampling for chemical analysis. Well depths shall be selected and construction details shall be such as to minimize the potential for cross contamination between different aquifer zones. Drilling fluid shall not be used without express permission of the Government, and only formation water shall be used if the use of drilling fluid is necessary. Soil samples shall be obtained from the target screened interval and analyzed for Atterberg limits (ASTM D 4318), grain size (ASTM C 136), and soil type (ASTM D 2487). The well riser shall consist of new threaded, flush joint, polyvinyl chloride (PVC) pipe with a nominal two (2) inch diameter, unless otherwise specified by the CO. The well screen shall be constructed of PVC material similar to the well riser. The sand pack gradation and screen slot size shall be chosen to suit the gradation of the in situ soils and minimize migration of fines into the well. Immediately above the sand pack, a five (5) foot layer of bentonite pellets shall be tamped in place around the casing. The remainder of the borehole annulus shall be filled with Portland cement grout, placed from bottom to top. If allowed by state requirements, 3% by weight of bentonite powder shall be mixed with the cement used for mixing grout. After the grout has cured for a minimum period of 48 hours, the well shall be developed by pumping and/or surging until the well water has clarified and water temperature, pH, specific conductivity, and other parameters have stabilized. Any well to be abandoned for any reason shall be grouted from the bottom to the top with Portland cement grout, and the casing cut off two (2) feet below ground surface.

7.4 Groundwater Sampling. Prior to collection of groundwater samples, the well shall be purged by removal of at least five well volumes and allowed to recover. If the well does not recover quickly enough to allow the removal of five well volumes, the well shall be bailed or pumped dry and allowed to recover.

8.0 **PUBLIC AFFAIRS**

The A-E shall not publicly disclose any data generated or reviewed under this contract. The A-E shall refer all requests for information concerning the site condition to the CEHNC Project Manager. Reports and data generated under this task order are the property of the Department of Defense and distribution to any other sources by the A-E, unless authorized by the Contracting Officer, is prohibited.

9.0 **REFERENCES**

9.1 "U.S. Army Corps of Engineers Safety and Health Requirements Manual," U.S. Army Engineer Manual EM 385-1-1, September 1996.

9.2 ETL 385-1-1, "Safety Concepts for Unexploded Ordnance," Huntsville Division, U.S. Army Corps of Engineers, 16 Dec 1992.

9.3 "Environmental Chemistry and Fate of Chemical Warfare Agents." Southwest Research Institute. Prepared for Corps of Engineers, Huntsville Division, March 3, 1994.

9.4 "Field Manual on Environmental Chemistry and Fate of Chemical Warfare Agents." Southwest Research Institute. Prepared for Corps of Engineers, Huntsville Division, July 7, 1994.

9.5 Army Regulation (AR) 385-40, "Accident Reporting and Records," with USACE Supplement.

9.6 DoD Directive 6055.9-STD, "DoD Explosives Safety Board," 25 November 1992.

9.7 "Safety and Occupational Health Document Requirements for Hazardous Waste Site Remedial Actions," Engineer Regulations 385-1-92, 18 March 1994.

9.8 "Chemical Data Quality Management for Hazardous Waste Remedial Activities," Engineer Regulation 1110-1-263, 1 Oct 90.

9.9 Occupational Safety and Health Administration Standards (29 CFR 1910 and 1926).

9.10 NIOSH/OSHA/USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985.

9.11 ANSI Z-358.1 "Emergency Eyewash and Shower Equipment," 1990.

9.12 ANSI Z-288.2 "Practices for Respiratory Protection," 1980.

9.13 RCRA Groundwater Monitoring Technical Enforcement Guidance Document.

9.14 "Test Methods for Evaluating Solid Wastes," USEPA Pub. No. SW-846, Latest Ed.

9.15 "Annual Book of ASTM Standards," Current edition.

9.16 "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA," EPA/540/G-89/004, October 1988.

9.17 "Chemical Quality Management -- Toxic and Hazardous," U.S. Army Engineering Regulation No. ER 1110-1-163, Current Edition.

9.18 U.S. Environmental Protection Agency (EPA). 1988b. CERCLA Compliance With Other Laws Manual. Parts I and II.

9.19 U.S. Environmental Protection Agency (EPA). 1989e. Methods for Evaluation the Attainment of Cleanup Standards. Volume I - Soils and Solid Media.

9.20 U.S. Environmental Protection Agency (EPA); Methods for the Determination of Organic Compounds in Drinking Water, Dec 1988.

9.21 U.S. Army Corps of Engineers, 1994, Cost Engineering Policy, U.S. Army Engineering Regulation No. 1110-3-1301, April.

9.22 Code of Federal Regulations. 40 CFR, Parts 190-299. latest edition.

9.23 Code of Federal Regulations. [n.d.] "Hazardous Waste Operations and Emergency Response." CFR 1910.120, Final Rule.

9.24 U.S. Army Corps of Engineers. 1989. "Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTW Projects." Memorandum, CEMRD-ED-GL. August.

9.25 U.S. Environmental Protection Agency (EPA). 1987. "Compendium of Superfund Field Operations Methods."

9.26 U.S. Environmental Protection Agency (EPA). 1988c. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA." EPA 540/g89/004. October.

9.27 AR 385-61, "Army Toxic Chemical Agent Safety Program," 22 June 1994 (Draft with letter of implementation).

9.28 DA PAM 385-61, "Toxic Chemical Agent Safety Standards,"

9.29 DA PAM 50-6, "Chemical Accident or Incident Response and Assistance (CAIRA) Operations," 17 May 1991 w/changes.

9.30 DA PAM 40-173, "Occupational Health Guidelines for Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT," 30 August 1991 w/changes.

9.31 AR 50-6, "Chemical Surety," 1 February 1995.

9.32 "Personnel and Work Standards for Ordnance Responses," U.S. Army Corps of Engineers Ordnance and Explosives Center of Expertise, 8 August 1996.

9.33 ETL 385-1-2, "Generic Scope of Work for Ordnance Avoidance," August 1996.

9.34 "Risk Assessment Guidance for Superfund (RAGS)," Vols I and II, US Environmental Protection Agency (EPA). 1989b.

9.35 "Archives Search Report Findings, Defense Depot Memphis, Tennessee," USACOE, St Louis District. January 1995.

9.36 "Archives Search Report Conclusions and Recommendations, Defense Depot Memphis, Tennessee," USACOE, St. Louis, District. January 1995.

9.37 "Defense Depot Memphis, Final Operable Unit One Field Sampling Plan," U.S. Army Corps of Engineers, Huntsville Engineering and Support Center, September 1995.

9.38 "Defense Depot Memphis Tennessee Generic Remedial Investigation/Feasibility Study Work Plan," CH2M-Hill, Inc., March 1995.

9.39 "Defense Depot Memphis Tennessee Operable Unit 1 Remedial Investigation/Feasibility Study Field Sampling Plan," CH2M-Hill, Inc., March 1995.

9.40 "Defense Depot Memphis Tennessee Generic Screening Sites Field Sampling Plan," CH2M-Hill, Inc., March 1995.

9.41 "Electromagnetic and Magnetic Surveys at Dunn Field, Defense Depot Memphis Tennessee," Technical Report GL-94-8, Waterways Experiment Station, March 1995.

9.42 "Defense Depot Memphis Tennessee RI/FS Quality Assurance Project Plan," CH2M-Hill, Inc., March 1995.

9.43 "US Army Base Realignment and Closure 95 Program. Sampling and Analysis Recommendations, Defense Depot Memphis Tennessee," Woodward Clyde, June 1996.

9.44 "Defense Depot Memphis Tennessee Generic Quality Assurance Project Plan," CH2M-Hill, Inc., August 1995.

** Additional References may be incorporated and will be finalized at the completion of negotiations.

Description	Negotiated Estimated Reimbursable Costs	Negotiated Fixed-Fee	Total Negotiated Costs	Funded Estimated Reimbursable Costs	Funded Fixed-Fee	Total Funded Costs
Task 1 - Prepare Work Plan	$ 65,652	$3,868	$ 69,520	$ 65,652	$3,868	$ 69,520
Task 2 - Perform Site Characterization	$158,551	$6,232	$164,783	$158,551	$6,232	$164,783
Task 3 - Letter Reports	$ 5,194	$ 312	$ 5,506	$ 5,194	$ 312	$ 5,506
Task 4 - IDW Disposal	$ 4,512	$ 270	$ 4,782	$ 4,512	$ 270	$ 4,782
Task 5 - Meetings and Public Involvement	$ 27,464	$1,648	$ 29,112	$ 27,464	$1,648	$ 29,112
Task 6 - Record and Submit Video Tape	$ 1,278	$ 77	$ 1,355	$ 1,278	$ 77	$ 1,355
Task 7 - Project Management	$ 32,489	$1,949	$ 34,438	$ 32,489	$1,949	$ 34,438
Task 8 - Location Surveys and Mapping	$ 8,575	$ 341	$ 8,916	$ 8,575	$ 341	$ 8,916
Task 9 - Perform Risk Assessment	$ 39,048	$2,343	$ 41,391	$ 39,048	$ 2,343	$ 41,391
Task 10 - Prepare EE/CA Report	$ 66,751	$4005	$ 70,756	$ 66,751	$ 4,005	$ 70,756
Task 11 - Prepare Action Memorandum	$ 11,127	$ 668	$ 11,795	$ 11,127	$ 668	$ 11,795
Task 12 - Schedule	$ -0-	$ -0-	$ -0-	$ -0-	$ -0-	$ -0-
TOTAL	$420,641	$21,713	$442,354	$420,641	$21,713	$442,354

TAB

Appendix F

APPENDIX F
CBDCOM SOP

327 310

EDGEWOOD RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER

CHEMICAL SUPPORT DIVISION

MONITORING BRANCH

MONITORING PLAN
FOR
DEFENSE DEPOT MEMPHIS, TENNESSEE

JULY, 1998

U.S. Army Edgewood Research, Development and
Engineering Center

1.0 INTRODUCTION. This document presents a monitoring plan for the U.S. Army Corps of Engineers remediation efforts at the Defense Depot, Memphis, Tennessee (DDMT). The purpose of this plan is to illustrate the strategy used by U. S. Army Corps of Engineers to monitor the airborne concentrations of recovered chemical warfare materiel during operations at the DDMT.

1.1 Purpose. This plan establishes the policies, objectives, procedures, and responsibilities for the execution of a monitoring program at DDMT. This plan describes the rationale for monitoring strategies for area and personal air monitoring and choice of monitoring equipment.

1.2 Scope. This monitoring plan applies to all facilities and operations within the DDMT involving air sampling and the head space screening of soil and surface water containing suspected recovered chemical warfare material (RCWM).

1.3 Objectives. The objectives of this plan are:

A. To illustrate the monitoring method used for each suspect RCWM operation performed at the DDMT.

B. To assure that all operations are monitored to ensure worker and public safety and health are maintained.

2.0 RESPONSIBILITIES

Chemical and Biological Defense Command (CBDCOM) will:

Maintain control over all monitoring data generated during this project.

Provide guidance on monitoring operations conducted on-site.

Conduct on-site analysis and confirmation for air samples and headspace samples collected from soil and surface water samples.

Provide equipment and trained and certified personnel to operate MINICAMS IAW Monitoring Branch IOP#16, Operation and Maintenance Procedures for MINICAMS Mounted in Mobile Vehicles, which is included as an appendix to this plan and maintain certification data as part of the Monitoring Branch 40-year data base.

Provide trained and certified personnel to set-up, and calibrate monitoring equipment and collect monitoring samples for personal and historical monitoring and historical monitoring stations IAW Monitoring Branch IOP MT-10 Site Monitoring Procedures Using DAAMS, which is included as an appendix to this plan and maintain certification data as part of the Monitoring Branch 40-year database.

Conduct all monitoring operations in accordance with the ERDEC's Monitoring Branch's Quality Control Plan.

Calibrate, challenge, and operate MINICAMS and/or Real Time Analytical Platform (RTAP) for real time analysis support during remediation operations during this project IAW

Monitoring Branch IOP#10 Site Monitoring Procedures Using DAAMS Tubes and the Real Time Analytical Platform (RTAP), which is included as an appendix to this plan and maintain certification data as part of the Monitoring Branch 40-year database.

Perform air-monitoring procedures as outlined in the Scope of Work.

Maintain all sampling records.

3.0 MONITORING

The intent of airborne monitoring is to indicate to workers when a hazardous atmosphere is present and to maintain a record of employee exposure to airborne RCWM, thus ensuring the safety of the operators, the environment, and the surrounding communities. The choice of monitoring equipment is based on the type of monitoring to be performed and the types of agent involved. The location of monitors or sample ports is based on the operation, the airflow in the area, and the location of the source of agents.

IN THE EVENT OF A POSITIVE RESPONSE TO AGENT, IN EXCESS OF 1 TWA/AEL FROM AIR MONITORING AND/OR SOLID SORBENT ANALYSIS, ERDEC MONITORING BRANCH PERSONNEL WILL IMMEDIATELY NOTIFY THE ON-SITE SAFETY OFFICER

3.1 Terms.

Airborne Exposure Limit (AEL). The AEL is the maximum allowable concentration in the air for occupational and general population exposures of any particular substance.

Personal Air Monitoring. Personal air monitoring is a method of sampling worker exposure to contaminants used in the work place. It evaluates potential exposure of the individual worker(s) at the work site. For RCWM operations, a sampling train is attached to the worker. The train consists of two or four Depot Area Air Monitoring System (DAAMS) tubes, which are connected to a dual-port sampler. The dual port sampler is attached by Tygon or Teflon tubing to a personal air pump. The train is calibrated to a specified air flow rate (liters per minute, LPM). The DAAMS tubes are placed in the worker's breathing zone (30 centimeters of the worker's oral-nasal region).

Depot Area Air Monitoring System (DAAMS). DAAMS is a portable air-sampling unit, which is designed to draw a controlled volume of air through a glass tube filled with a collection material (for example Tenax GC). As the air is passed through the solid sorbent tube, agent is collected on a sorbent bed. After sampling for the predetermined period of time and flow rate, the tube is removed from the vacuum line. The tube is transferred to the RTAP or MEAP where it is analyzed (approximately one hour process time) or sent to the ERDEC Monitoring Branch laboratory. The purpose of the analysis is to determine the presence, type, and quantity of agent collected in the sampling tubes. This technique will sample down to the AEL (HD = 0.003 mg/m3 and L = 0.003 mg/m3) and provides low-level detection capability for HD and L.

Flow Log. A record of the flow measurements taken during the set up of monitoring stations.

General Area Monitoring. General area monitoring provides an early warning to personnel that there is a problem and that action must be taken. The monitoring device or sampling port is placed at strategic locations in the work area where there is a potential for encountering agent vapors. The sample locations are determined based on such factors as the agent involved, the airflow patterns in the area, the operation(s) being performed, and the location of the source of the potential release.

Immediately Dangerous to Life and Health (IDLH). The IDLH is a condition posing an immediate threat to life, health or a severe exposure to contamination likely to have adverse effects on health. This condition includes atmospheres where oxygen content by volume is less than 16 percent.

Internal Operating Procedures (IOP). Previously approved written monitoring and analysis procedures used by the CBDCOM at remediation sites.

Low-level Alarm. Low-level alarm is a device used in conjunction with a low-level monitor or detector, which produces an audible sound and flashing light when the appropriate concentration above the AEL is detected.

Low-level Detectors. Low-level detectors are those detection devices that can provide detection capability and/or alarm for concentrations of 0.003 mg/m3 for Mustard (H) and Lewisite (L). Examples include DAAMS and the instrumentation used in the RTAP and MINICAMS.

Miniature Chemical Agent Monitoring System (MINICAMS). MINICAMS is an automatic air monitoring system that collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas chromatography column for separation, detects the compounds with a flame-photometric detector or Halogen Specific Detector. It is a lightweight, portable, low-level monitor designed to respond in less than five minutes with alarm capability.

Personnel Roster. The personnel record is a record of the people on-site during the conduct of operations at DDMT Sites.

QL. A Quality Laboratory sample is a quality control sample that has been spiked with a solution of an analyzed dilute chemical agent in the laboratory but which has not been aspirated at a sampling site.

QP. A Quality Plant sample is a quality control sample that has been spiked with a solution of an analyzed dilute chemical agent and exposed to the sampling environment.

Real Time Analysis Platform (RTAP). The RTAP provides an automatic continuous environmental monitoring system that collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas chromatography column, and detects the compounds with a Halogen Specific Detector (XDS), simultaneous phosphorous and sulfur, dual headed flame photometric detector (FPD), or an electron Capture Detector (ECD). The RTAP is a self-contained mobile platform that can be moved from site to site. It is a mobile, low level monitor designed to respond in less than 10 minutes with alarm capability.

Scratch Log. Contains all pertinent information short of analytical results. Also used as tracking device for samples and chain of custody.

Standing Operating Procedures (SOP). Previously approved written monitoring and analysis procedures used by the ERDEC Monitoring Branch. These procedures were developed for a laboratory operation and only portions of the SOPs apply to field operations.

Time Weighted Average (TWA). TWA is the employee's average airborne exposure in any eight-hour work shift of a forty-hour workweek, which shall not be exceeded.

3X (XXX). XXX indicates that the item has been surfaced decontaminated by approved procedures, bagged or contained, and that appropriate tests or monitoring have verified that vapor concentrations above the AEL or TWA limits for the specific agent(s) do not exist. Does not apply to a decontaminated liquid, detoxified liquid, a neutralent, or a gas. Some items may be released from Government control if all Federal, State and local provisions have been met.

3.2 Types of Monitoring for DDMT.

Real Time. CBDCOM will conduct real time monitoring at DDMT in support of remediation efforts as needed. All work areas will be monitored in real time with MINICAMS and/or RTAP as dictated by the work scenarios. Primary monitoring will be provided by a vehicle equipped with MINICAMS configured to monitor for Mustard and Lewisite.

Confirmation/Historical. Historical monitoring will be achieved through both personal and general area monitoring using DAAMS tubes. The DAAMS samples will not be used to immediately warn of hazardous conditions, but they will be used to document conditions over time and to confirm the results of the real time monitors. The DAAMS samples for Mustard and Lewisite may be analyzed either at an ERDEC laboratory or the RTAP that will be on site.

Soil and Water Sample Headspace Monitoring and Verification. This monitoring will be completed through the use of DAAMS tubes and/or MINICAMS for Mustard and Lewisite on suspect soil surrounding a potential RCWM contaminated item.

Personal Monitoring. At this time is not expected that breathing zone monitoring will be needed. If the need to monitoring worker's breathing zones, the monitoring will be performed as listed below.

1. **Exclusion Zone, if required.** This monitoring will be required for every individual crossing into the exclusion zone. DAAMS tubes for Mustard and Lewisite will be collected.

2. **Work Area.** This monitoring will be required for 33 percent of individuals crossing into the work area. DAAMS tubes for Mustard and Lewisite will be collected.

Quality control over analysis is maintained and verification testing is performed according to the Monitoring Branch Quality Control Plan or the off-site laboratory's Quality Control Plan.

Damaged sample containers, sample-labeling discrepancies will be noted on the COC form. The laboratory will contact the Project Manager if a problem develops for resolution.

3.3 Monitoring Procedures/Analysis. Upon receipt of the DAAMS sample tubes and signing of the proper chain-of-custody sheets, the DAAMS tubes will be dried, heated and purged with

Nitrogen on a Dynatherm ACEM 900 thermal description unit and analyzed on a Hewlett-Packard 890 GC with a dual flame photometric detector. The MINICAMS will be calibrated per MINICAMS IOP # MT-16. ERDEC will maintain control over all results and data generated from the analyses. A matrix of monitoring procedures is attached as page 7.

Real Time. Real time air monitoring will be accomplished by using the MINICAMS and RTAP set to alarm at 80 percent of TWA hazard level for H and L the MINICAMS/RTAP system will provide early, rapid warning of airborne exposure hazards at the excavation point.

The MINICAMS/RTAP can detect HD, and L at either IDLH (immediately dangerous to life and health) or TWA (time weighted average) levels. The system consists of a monitor (sample collection, analysis, detection, and alarm equipment), vacuum pump, heated sample transfer lines, compressed gases, and computer. In the sampling cycle, a vacuum pump draws air into the MINICAMS/RTAP system through a heated sample transfer line to prevent any chemical material transported in the lines from condensing out on the walls of the transfer line. The air sample is drawn through an automated gas chromatograph that first collects agent on a solid sorbent and then thermally desorbs the agent into a separation column for analysis. A XSD or ECD, which responds to Chlorine containing compounds, or an FPD, which responds to Sulfur and Phosphorous containing compounds, detects the components eluting from the column. A direct readout, in units of the hazard level, is provided. A permanent trace of the chromatogram is stored in the computer. If RCWM is detected at the hazard level preprogrammed by the operator, the MINICAMS/RTAP system alarm will activate and the workers will take immediate actions. The MINICAMS/RTAP does not sample continuously because sampling is stopped during the thermal-desorption step.

Each MINICAMS/RTAP unit shall be checked daily to determine if calibration is required. Appropriate action shall be taken to correct any malfunctions found. After completion of the instrument observation, an agent challenge shall be made to verify that the MINICAMS/RTAP performance is acceptable and to see whether calibration is necessary. An aliquot of a Quality Control (QC) standard solution of the agent of interest is injected. The concentration of the standard solution shall be such that the injection contains 1.0 +/- 10% TWA or IDLH of the agent, depending on the hazard level the MINICAMS/RTAP is programmed to detect. If the MINICAMS/RTAP response is within 25% of the challenge level, it is not necessary to calibrate the MINICAMS/RTAP unit. If the response is not within 25% of the actual challenge level, the unit shall be challenged again. If it fails a second challenge, it shall be recalibrated.

The MINICAMS/RTAP unit shall be calibrated IAW the instructions given in the appropriate Monitoring Branch IOPs. After the calibration has been completed, an injection containing 1 TWA of the agent shall be made. If the MINICAMS response is between .75 and 1.25 TWA, the calibration is considered satisfactory.

CBDCOM SITE MONITORING

	MINICAMS/RTAP	DAAMS (Perimeter)	DAAMS (Personnel)	OpFTIR (Perimeter)
Locations	1 – PDS 2 - Work site 2 – Extra	1 – upwind; up to 3 downwind	1-2 persons inside the hot line	Upwind background; downwind continuous
Frequency	Continuous	Up to 8 hours	Up to 8 hours	5 minute Averages
Analysis Time	Approx. 10 minutes	HD - 10 min L - 30 min	HD - 10 min L - 30 min	HD – Instantaneous L - Instantaneous
# People	1-2 MINICAMS operators	1-2 – Sample Collection Technicians	1 RTAP Operator	1- OP-FTIR Operator
Target Agent	HD/L	HD/L	HD/L	HD/L
Lowest Level of Detection	HD/L - 0.00075 mg/m3 CG/PS/CHCl3 - 0.025 ppm	HD: 2 ng L: 20 ng	HD: 2 ng L : 20 ng	HD: .18 mg/m3 L : .09mg/m3
Action Level	HD: 0.003 mg/m3	HD: 0.003 mg/m3 L : 0.003 mg/m3	HD: 0.003 mg/m3 L : 0.003 mg/m3	HD: .18 mg/m3 L : .09mg/m3

Data Evaluation

The performance of the MINICAMS/RTAP is monitored daily. Each day a challenge is made to the MINICAMS/RTAP using a standard of known concentration. The standard is made up to reflect the 1 TWA level for the agent being monitored. The area, peak height, retention time, peak width and injection size and the name of the technician are recorded on a log sheet.

Control Samples

The MINICAMS/RTAP is challenged daily with standard solutions of chemical agents at concentrations which will give readings of one TWA shall be made when the instrument is functioning properly.

A MINICAMS/RTAP sample is defined as the volume of air, which is sampled during one automatic cycle of the instrument for the agent being monitored. To prepare a challenge sample for the MINICAMS/RTAP, a known volume of a standard dilute chemical agent is injected into the sample inlet.

Quality Control of Agent Sample Lines

All agent sample lines will be challenged at least weekly with chemical agent to verify that their transmission efficiency remains high and is documented. A calibrated MINICAMS/RTAP as the detector will be used to test the sample line. Prior to testing the sample line, the MINICAMS/RTAP will be challenged so that the transmission efficiency of the sample line may be determined directly. Spiking levels are the same as those normally used for daily challenges. All injections will be at the sample collection end of the sample line.

A record of the test date, time, and result will be maintained for each sample line. This record will be maintained at the monitoring station to which the sample line is connected.

Agent Challenge Log Sheet

All challenges of chemical agent monitors with agent will be recorded on an agent challenge log sheet.

b) **Confirmation/Historical.** Historical air samples may be collected over several hours, as in background samples or a few minutes, as in soil sample headspace. Also, they can be collected on a daily basis or periodically.

DAAMS sampling stations that will be located along the perimeter of the excavation point will collect samples to confirm real time alarms for H and L. These will also provide historical records. DAAMS analysis consists of sampling stations, solid sorbent tubes, and a modified GC. At each DAAMS station, a vacuum pump will be used to continuously draw air through the DAAMS tube at a controlled flow rate. After the required time (per Monitoring Branch QC Plan and IOP # MT 10), the DAAMS tube will be collected and transported to the RTAP/MEAP or, when necessary, the ERDEC laboratory for sample analysis using a GC. The tube is a then heated and trapped chemical desorbed from the DAAMS tube. Nitrogen is forced through the tube to carry the desorbed chemical agent into a capillary column for chromatographic separation. The separated chemical agents elute into the detector, where they will be identified and quantified.

Notification.

Notify the On-Site Safety Officer at DDMT of any result above the 8-hour time weighted average (TWA), Airborne Exposure Level (AEL).

Air Sampling Records.

Maintain copies of all personnel air sampling results for inclusion in employee medical records. Maintain all sampling records IAW AR 40-5 and 29 CFR 1910.120 requirements.

c) **Soil Headspace Monitoring.** Setups for soil headspace monitoring shall consist of dual DAAMS tubes for Mustard and Lewisite agents.

For temperatures in excess of 80 degrees Fahrenheit:

1) Place the sample in direct sunlight.

2) Insert the soil temperature probe into the soil.

3) Observe the sample until the internal temperature reaches 80 degrees Fahrenheit.

4) Wait 15 minutes, and then collect the sample in the normal fashion, as described below.

For temperatures below 80 degrees Fahrenheit:

1) Place the sample in direct sunlight or a heater box, and turn the box on.

2) Insert the soil temperature probe into the soil.

3) Observe the sample until the internal temperature reaches 80 degrees Fahrenheit.

4) Wait 15 minutes, and then collect the sample in the normal fashion, as described below.

See MT-10 attached as Appendix for Set up procedures.

Notification.

Notify the On-Site Safety Officer of any result above the 8-hour time TWA, AEL.

Air Sampling Records.

Maintain copies of all personnel air sampling results for inclusion in employee medical records. Maintain all sampling records IAW AR 40-5 and 29 CFR 1910.120 requirements.

d) **Personal Monitoring.** If required, personal air sampling will be used for confirmation monitoring for personnel entering into the exclusion zone or work zone. Each person is fitted with portable sampling pumps. Each pump is set with two - four DAAMS tubes to monitor for Mustard and Lewisite agents. DAAMS tubes are positioned within the personnel's breathing zone. Personal monitoring pumps are run for a maximum of eight hours and a minimum of one hour and fifteen minutes per day. Flow rates for personal pumps are determined in accordance with the internal operating procedures used by the Monitoring Branch personnel. Personal air sample results are legal documentation of worker exposure, and require special attention to calibration, filling out of forms, and chain of custody. The records shall be kept IAW the requirements outlined in AR 40-5, Preventive Medicine, for Government personnel, and IAW the requirements in 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, for contractor and Government personnel. See MT-10 attached as Appendix for Set up procedures.

Notification.

Notify the On-Site Safety Officer at DDMT of any result above the 8-hour time weighted average (TWA), Airborne Exposure Level (AEL).

Air Sampling Records.

Maintain copies of all personnel air sampling results for inclusion in employee medical records. Maintain all sampling records IAW AR 40-5 and 29 CFR 1910.120 requirements.

3.3 Historical Records. Monitoring branch technicians shall maintain the electronic database for all samples collected with DAAMS tubes. Records of MINICAMS and RTAP analyses, the flow calibrations, branch personnel will also maintain challenges of the MINICAMS and RTAP. Monitoring branch personnel shall be responsible for certifying that monitoring operations are conducted according to this plan or the site-specific QC plan. The contractor will obtain the sampling analyses documents (if any) the off-site laboratory will prepare in support of the DDMT project.

3.4 Quality Control. At least two QP samples shall be run daily for each type of analysis performed. A 1.0 TWA QP sample shall be run every 20 samples on the DAAMS system and a minimum of every four hours on the MINICAMS and RTAP monitors.

3.5 Monitoring Contingency. In the event of unforeseen circumstances, the Monitoring group will notify the On-Site Safety Officer to briefly halt operations in order to catch up in the analysis of field samples.

APPENDIX A

SITE MONITORING PROCEDURES USING DAAMS TUBES

AND

THE REAL TIME ANALYTICAL PLATFORM (RTAP)

Internal Operating Procedure: Operations Directorate

Monitoring Branch

Title:	Site Monitoring Procedures Using DAAMS tubes and the Real Time Analytical Platform (RTAP)
Division:	Chemical Operations
Branch:	Monitoring Branch
Building/Area:	In vicinity of E3346 and other areas nationwide

This internal operating procedure covers operations, methods and procedures of a general nature not covered by a standing operating procedure. This procedure will be effective until rescinded or superseded.

Changes to this procedure will be accomplished by submission of revisions or amendments for approval.

ubmitted by:

K. Maguire
Monitoring Team

Approved by:

F. G. Lattin
Chief, Monitoring Branch

Date:	April 8, 1997
IOP Number:	MT-10
Revision Number:	0
Prepared by:	K. Maguire - N. Snyder X8428 X 4623
Approved by:	F. G. Lattin X4479

Title: Site Monitoring Procedures Using DAAMS Tubes and the Real Time Analytical Platform

Operator's Statement: I have read, or have had read to me the procedures in this IOP. I, by my signature below, indicate that I thoroughly understand and agree to abide by these instructions.

Signature	Date	Signature	Date

Supervisor's Statement: I have personally reviewed this IOP and, to the best of my knowledge, believe that the information listed herein is correct.

Supervisor: ______________________ **Date:** ______________________

F. G. Lattin

REAL TIME ANALYTICAL PLATFORM

General Information. For responsibilities, general safety requirements, first aid, decontamination, disposal, and emergency procedures refer to ERDECR 395-15. For hazards (general or specific) see the Material Safety Data Sheets (MSDS) at the site to be monitored.

Equipment Required:

Real Time Analytical Platform equipped with:

- Gas chromatograph/dual flame photometric detector and/or GC/ECD
- Dynatherm ACEM 900
- heated vapor sample lines (2 - each of 120 feet)
- Fume hood
- hydrogen and nitrogen/air generator
- safety equipment
- ChemStation with software
- Vacuum pump and vacuum interface

DAAMS Tubes
Sampling Pump
Calibrated Flow Meter
PC with Tag Program
HP Combo Standard & Lewisite (when necessary)
Syringes and spiking block
Tubing
Gemini Dual Port Sampler
Distilled, deionized water

Detailed Procedures:

Departure to Site:

1. Ensure all loose items are secured.

2. Ensure that paper trays for all printers are filled.

3. Ensure that the label printer is filled.

4. Start up and check fuel level of power generators.
5. Check Daily Challenges and printouts to ensure instruments and data are within operating specifications.

6. Cellular Phone in RTAP

7. Check oil level prior to starting

Initial Site Set-Up: DAAMS Tubes

1. Remove DAAMS tubes from the protective carriers. Inspect tubes to ensure there are no chipped ends or cracks. Do not use damaged tubes.

2. Write DAAMS tube numbers on upper right hand corner of the sample tag. **NOTE:** When using dual tubes the lowest numbered tube is listed first, with the second tube being listed below the first (See Figure 1). The lowest numbered DAAMS tube will be analyzed by the chemists first, once the sampled is received.

Figure 1. Field TagBldg. No. Date	2nd Tube No.	1st Tube No.
Flow Rate 1st Tube 2nd Tube	Sample ID	Flow Rate 1st Tube. 2nd Tube
(3 flow rates are required before samples are placed adjust flow with Gemini)		(3 flow rates are required after samples are picked DO NOT ADJUST FLOWS)
Time On ________		Time Off ________

3. Check sampling pumps for proper sampling time (4 hours for perimeter sampling and 2 hours for personnel monitoring). Check that the harness is attached and that the Gemini Dual Port Samplers are connected.

4. Connect the downstream end of the tygon tubing harness to the air monitoring pump.

5. Connect the GLASS WOOL side of the DAAMS tube to the Gemini Dual Port Sampler (Gemini). Two DAAMS tubes will be used concurrently during the monitoring procedure. The analysis of the DAAMS tube during desorption is a one-shot occurrence. If the desorbed sample is not analyzed as anticipated, the sample cannot be recovered. Therefore, a second tube is used as a backup.

6. Attach a Gemini to the sampling pump.

7. Using a calibrated flowmeter, adjust the flows through the DAAMS tubes by adjusting the set screws on the Gemini to the required rates. Take three (3) readings with the calibrator. If the third reading is within 10 percent of the first two readings record the flow rates on the sample tag as indicated in Figure 1. Flow rates for specific sampling procedures are shown in Table 1.

Table 1. MONITORING FLOW AND SAMPLE RATES

Sample Type	Description and Preparation Procedures Prior to Sampling	Pump Sample Time	Flow Rates
IX Items (small)	Size should be limited to less than 3' x 3' x 3'.	30 min.	500 mls/min.
Soil Samples	Sample jar of soil shall be doubled bagged. Dual tubes shall be run on all soil samples.	30 min.	500 mls/min.
TAP Clothing	TAP clothing shall be double-bagged and sealed.	30 min.	500 mls/min.
IX Items (large)	Items shall be larger than 3 x 3 x 3 feet. Items should be placed on a pallet and wrapped in plastic. For extremely large items 2 samples should be taken on the items.	1 hour	250 mls/min.
	Dual DAAMS Tubes Shall be Used for All Monitoring Listed Below		
Personnel Monitoring	Monitors shall be placed on the person with the 2 DAAMS tubes approximately 30 cm from the breathing zone of the individual.	2 hours	200 mls/min.
Perimeter Monitoring for Clean-up Sites	A minimum of 4 positions shall be set up. First position shall be located at the point source. Dual tubes shall be used for all positions.	2 hours	200 mls/min.
Area/Perimeter Monitoring	Area shall be monitored for 4 or 8 hours. A minimum of three positions shall be set up. Pumps can be set to run for 4 or 8 hours.	4 hours 8 hours	100 mls/min. 50 mls/min.

8. Locate and secure the pump on the area to be monitored so that it cannot be knocked over or entangled with personnel or equipment. Place perimeter stands (Positions A through D). Place the appropriate pumps on the stands and set up personnel monitors (See section on Personnel Monitoring with DAAMS Tubes). (All perimeter pumps and stands should be labeled A through D to avoid confusion prior to placement.)

9. All information must be recorded in the TAG program and on the tag itself. The information will depend on what type of monitoring is required. Enter information into the TAG program, print out tag and associated document and label sample. The program will prompt the user for appropriate information that must be included on the sample tag.

10. Fill out flow sheet with position ID. Enter the tube numbers in the space labeled tubes and record the flow rates taken.

11. When operations start, turn on the pump to start the sample and write the starting time on the field tag.

Initial Set Up: Background Monitoring with DAAMS Tubes

1. Outdoors: Assess the area and set up a minimum of three positions, (more if deemed necessary). Positions should be approximately 12 - 20 feet apart and set up approximately 50 feet down wind from the source to be monitored.

2. Indoors: Assess the area and set up a minimum of two positions, (more if deemed necessary). For extremely small areas (10' x 10' or less), set up one position using dual tubes.

3. Refer to DAAMS tube set up, Steps 1-7, as applicable.

4. Fill out flow sheet with position ID. Enter the tube numbers in the space labeled tubes and record the flow rates taken.

5. Repeat steps 1-4 as appropriate throughout the day. Ensure that a set of perimeter monitors is always ready since background/perimeter monitors are exchanged every fours hours.

Initial Set Up: Personnel Monitoring with DAAMS Tubes

Personal air sampling will be used for both first entry and quarterly period sampling requirements. Personal air sample results are legal documentation of worker exposure, and require special attention to calibration and the chain of custody. Personal air sampling results which are positive will be forwarded to the site safety officer.

1. Refer to DAAMS tube set up, Steps 1-10, as applicable.

2. Secure the pump to the outside of the employee's clothing using a belt. Situate the pump as comfortably as possible without being entangled with the worker's clothing or nearby equipment.

3. DAAMS tubes should be located within approximately 30 centimeters of the employee's nose.

4. Observe the pump for approximately three minutes to ensure it is working correctly. **Advise the wearer that under no circumstances are they to turn the pump on or off.** Wearers shall notify monitoring personnel should any situation arise that requires removal or adjustment of the pump, or if pump stops.

5. Record Air Pump Calibration Flow Rates on the flow sheet using the last four digits of the monitored individual's SSN. The last four digits are used as the ID. Enter the tube numbers in the space labeled tubes and record the flow rates taken.

6. Repeat steps 1-5 as appropriate throughout the day. Ensure that a set of personnel monitors is always ready since personnel monitors are exchanged every two hours.

Initial Start Up: RTAP

1. Uncoil and emplace heated sampling line.

2. Check gasoline generators used to heat sampling line for oil and fuel level.

3. Heat lines by connecting electrical power cords into the portable generators or heat while still on shore power.

4. Upon entering the RTAP, verify there is (shore) power going to the instruments.
   If yes, go on to Step 6.

5. If no, check the circuit breakers on the wall just behind the drivers seat in the analytical portion of the truck. **If there is a tripped breaker, STOP.** Turn the GCs off (on the lower right side near the back). Next turn off the Hydrogen and Nitrogen generators - to prevent blowing internal fuses. Turn off all extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/ heaters, computer monitors and printers. Leave the hard drive on. VERIFY that the system is drawing 10 amps or less. Flip the breaker, and proceed to turn the above mentioned back on as needed. If the gas generators do not respond immediate, adjust the Electronic Pressure Control (EPC) accordingly.

6. For running off internal generators, initiate the following:

   (a) Start the supplemental power generators, and let them warm up for about 10 minutes.

   (b) Turn off extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/heaters, computer monitors and, in this case, GC ovens.

   (c) Make sure that the system is BELOW 10 amps on the master power control panel BEFORE you unplug the vehicle from shore power. (Let the instruments run off one generator and the utilities run off of the other generator.)

   (d) Unplug the shore power cord from the RTAP's external outlet and turn on the utilities necessary.

   (e) The heated sample line that is directly hooked up to the analytical equipment may be plugged in on the instrument side of the RTAP in any outlet marked "A". Any other heated sample line that needs to be used should be plugged in on the utility side (in any outlet marked "B") of the RTAP during initial heating. DO NOT plug two unheated sample lines into the same outlet, they will trip the breaker.

Depending on length, when a line is first plugged in, it will draw 10-15 amps to heat up, then level out around 7 amps. Each outlet can only hold a max of 15 amps. Therefore, two already heated sample lines can be accommodated by one outlet.

7. Conduct an initial (morning) RTAP challenge (using a DAAMS Tube/GC). Check to see if the system is ready, the flame is lit and the ChemStation is in "Ready" status.

   (a) Run a blank (this can be done while the generators warm up). If the blank is normal (clear), spike the fast flow tube with 4µl of agent standard (HP Combo) and run the DAAMS tube. Record usage on the Usage Record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

   (b) If the challenge passes, the GC system is ready to begin sampling.

   (c) If the challenge does not pass, repeat the challenge. If the second challenge fails, per the Monitoring Branch Quality Control (QC) Plan, recalibrate or troubleshoot (see system manual). Record standard usage on the agent usage record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

8. Conduct the initial (morning) RTAP challenge using a Heated Sampling Line. Check to see if the system is ready, the flame is lit and the ChemStation is in "READY" status.

   (a) Run a blank (this can be done while the generators warm up). If the blank is clear, spike the fast flow tube with 4µl of standard (HP Combo) and run the DAAMS tube. Record standard usage on the agent usage record (Attachment 1). Record results on the Monitoring Data Record (Attachment 2).

   (b) If the challenge does not pass, repeat the challenge. If the second challenge fails, per the Monitoring Branch QC Plan, stop and recalibrate and/or troubleshoot the problem. Record standard usage on the agent usage record (Attachment 1). Record results on the Monitoring Data Record (Attachment 2).

   (c) If the challenge passes, challenge the heated sample line. Plug in line(s) and let them heat for at least 30 minutes (60 minutes in cold weather).

   (d) Stretch the line out so that it is not coiled while it is heating. Make sure that there is a filter on the end BEFORE turning on the vacuum pump.

   (e) Make sure that the line is connected to the vacuum interface BEFORE making a challenge shot.

   (f) After all challenges are successful, create a directory in the ChemStation. On the main menu screen, go into "Run Control" and then to "Sample Info" to enter your name, the project, etc. This should be updated every day. Record any troubleshooting or changes to the GC configuration on the GC Preventive Maintenance Log (Attachment 3).

(g) Run a blank through the heated sample line and compare it to the "tube only" blank [see Step (a)]. The line challenge shows the kind of background that may be present in the line and in the air.

(h) If no peak appears in the retention time widow for the agent of interest, challenge the line. If a peak does appear in the retention time widow for the agent, further blanks may be necessary at the discretion of the operator.

(i) To challenge the line, press the "START" button on the Dynatherm and shoot 4 µl of HP Combo into the end of the heated sample line. **Make sure that the external sample is set for the appropriate sample time.** Record standard usage on the agent usage record (Attachment 1). Record results on the Monitoring Data Record (Attachment 2).

(j) If the line challenge passes, the system is ready to begin real time sampling. If the line challenge does not pass, check the fittings and the vacuum flow filters. Also check to see if the vacuum is on, the vacuum interface filter is clean, the heated sampling lines are hot and the fittings are tight. Repeat the challenge. If the second challenge fails, per the Monitoring Branch QC Plan, troubleshoot the problem. (Since a successful challenge has already been run on the tube, the heated sample line, and not the GC, may be the problem.)

Initial Set Up: DAAMS Monitoring of Bulk Material

1. Remove DAAMS tubes from the protective carriers. Inspect tubes to ensure there are no chipped ends or cracks. Do not use damaged tubes.

2. Write DAAMS tube numbers on upper right hand corner of the sample tag. **NOTE:** When using dual tubes the lowest numbered tube is listed first, with the second tube being listed below the first (See Figure 1). The lowest numbered DAAMS tube will be analyzed by the chemists, first, once the sampled is received.

3. Connect the downstream end of the tygon tubing harness to an air monitoring pump.

4. Connect the GLASS WOOL side of the DAAMS tube to the Gemini Dual Port Sampler (Gemini). Two DAAMS tubes will be used concurrently during the monitoring procedure. The analysis of the DAAMS tube during desorption is a one-shot occurrence. If the desorbed sample is not analyzed as anticipated, the sample cannot be recovered. Therefore, a second tube is used as a backup or for confirmation.

5. Attach a Gemini to the sampling pump.

6. Using a calibrated flowmeter, adjust the flows through the DAAMS tubes by adjusting the set screws on the Gemini to the required rates. Take three (3) readings with the

calibrator. If the third reading is within 10 percent of the first two readings record the flow rates on the sample tag as indicated in Figure 1. Flow rates for specific sampling procedures are shown in Table 1.

7. Insert frit end of DAAMS tube through all layers of wrapping material and clear of obstructions or liquid submersion. **Do not insert tube into liquid or soils. if liquid is drawn onto tube, stop the sample, get new tubes and start over.**

8. Turn on the pump to start the sample and write the starting time on the field tag.

Monitoring with DAAMS Tubes

1. Periodically check tubes to ensure connections and flow rates are stable. The amount of time for Monitoring will depend on the type of monitoring conducted (See Table 1). Perform any maintenance, repair and cleaning as required. Maintain the worksite, including the interior of the RTAP, to ensure that all surfaces are clean and dirt/dust free.

2. Before disconnecting the DAAMS tubes samples from the tygon harness:

   (a) Write the time the sample finished on the field tag

   (b) Verify that the DAAMS tube numbers are written on the upper-right hand corner of the sample tag

   (c) Verify that the DAAMS tube numbers match the numbers written on the sample tag

   (d) Verify that the identification number for the sample is written on the sample tag and the actual sample (use permanent marker when marking the item being sampled). For personnel monitoring the last 4 digits of their SSN is used for ID.

   (e) Take three readings using a calibrated flowmeter for each DAAMS tube used during the sampling process and record the flows on the field tag. **DO NOT make any adjustment to the flow rates.**

3. Remove the DAAMS tube from the Gemini and place the frit end into the protective carrier first. Replace the cap.

4. Log samples into the Tag program and record flow information. Technicians will annotate any sample discrepancies on the scratch log and any flow discrepancies in the flow sheet. Verify all information is correct and samples are properly identified prior to the analysis.

5. Take samples to the RTAP where the chemist will verify receipt and annotate the scratchlog. Any discrepancies during the analysis will be recorded, by the chemist on the data sheet. These comments shall be added to the comment section of the database program.

6. All data will be collected on the computer in the RTAP, downloaded and added to the data in Room 188, Building E-3346 (at the Edgewood area) at the end of each month.

7. Record the following required information in the appropriate location on the scratchlog, the personnel roster or the flow log.

Scratch log
- (a) Location
- (b) Sample identification number
- (c) Date of sample
- (d) Agent(s) being tested for
- (e) Type of sample (Background, SOP, TAPC1, etc.)
- (f) Time ON and OFF for samples
- (g) Point of contact and extension number
- (h) Chain of custody signatures, date & time

Personnel Roster
- (a) Sample identification number
- (b) Date of sample
- (c) Agent(s) being tested for
- (d) SOP number(s)
- (e) Point of contract and extension number
- (f) Names of personnel present during operation and SSN
- (g) Times (in and out) personnel were present during operations
- (h) signature of technicians setting up SOP

Flow Record
- (a) Location
- (b) Sample identification number
- (c) DAAMS tube number (lowest number listed first)
- (d) Flow rates for all tubes prior to sample being run
- (e) Flow rates for all tubes at conclusion on sample run
- (f) Comments on any discrepancies concerning tube flows (i.e. tubes contaminated with dirt/liquid, tubes broken)

8. One QP (quality plant) sample per every 20 samples will be collected to ensure that no tampering or sampling anomalies occur. A QP is a sample spiked with a known concentration of analyte and analyzed with the field samples. The results are used to validate the performance of the system. Record standard usage on the agent usage record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

9. Sampling tags are generated from a PC database program. The tags are attached to the carrier of the DAAMS tube and removed by the analyst during the analysis and affixed to the chromatogram. Tube numbers are written on tag for each sample prior to the analysis.

---

1 Toxicological Agent Protective Clothing.

10. The analytical results are filled out on the data analysis sheet and entered into the monitoring database.

11. Notify the site safety personnel of any result above the 8 hour time weighted average (TWA) airborne Exposure Level.

DAAMS Tubes Sampling with the RTAP

1. Remain in standby mode until samples are received. Per Monitoring Branch QC Plan, for every 10 DAAMS samples, you must run a 4 µl challenge and challenge the instrument again at the end of the day after the last sample has been run. Record standard usage on the agent usage record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

Real Time Sampling with the RTAP

1. For Real Time sampling, once challenged, the operator may wish to set the Dynatherm "CYCLE" button to "INFINITE" and "RECYCLE" button to "4 MIN". Once the start button is pressed - the system continuously runs until stopped by the operator. Per the QC Plan, the line must be challenged every four hours, with a 4 µl challenge and again after the last sample at the end of the day. Record standard usage on the agent usage record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

Headspace Monitoring for Soil Samples using the RTAP

1. When soil samples are received, plug in the heater box. Verify that soils are identified. If not, the technician assigns an identification number.

2. Place the soil sample into the heater box (do not place the soil sample bag next to the light; it will melt.)

3. Heat the soil sample for 10 minutes, then remove the sample and place it in the fume hood. Turn off the heater box when all samples are completed.

4. Allow the sample to off-gas for 10 minutes in the hood. Set up DAAMS tubes for 500 mls/min to be used for the headspace sample and record the flow rates.

5. Insert the DAAMS tubes into the sample bag and sample the soil for 30 minutes.

6. Remove the DAAMS tubes and tape the hole in the bag.

7. Record the flows and enter the sample information into the TAG program.

8. Give the sample, the TAG and data sheets to the RTAP operator for analysis.

9. Once the sample has been cleared, return the sample to the field team for disposal. **It's very important that no samples should remain** in the RTAP overnight.

Site Shutdown:

1. Collect all perimeter and personnel monitoring samples. Record the flows as required. Give all samples, tags and data sheets to the RTAP operator.

2. Ensure that there is sufficient gas in the RTAP for the next day's operation. Refuel the vehicle if necessary. Put all gas receipts in the vehicle maintenance log. Write the mileage (odometer reading) on the gas receipt.

3. Complete the final RTAP challenge of the day. Record standard usage on the agent usage record (Attachment 1). Record challenge results on the Monitoring Data Record (Attachment 2).

4. If shore power is not required, go on to the Final Checks. If shore power is required:

   (a) Turn off extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/ heaters, computer monitors and in this case GC ovens. Leave appropriate utilities and instruments on.

   (b) Make sure that the system is BELOW 10 amps on the master power control panel box BEFORE the vehicle is plugged into shore power.

5. Conduct Final Checks:

   (a) Turn GC oven back on.

   (b) Adjust internal RTAP ambient temperature in relation to outside temperature (if it's hot outside, turn on AC; if it's cold, turn on heat).

   (c) Check vacuum interface filter for dirt and/or replace dust filters on heated sampling lines if the chromotography suggests a need to do so.

   (d) Collect and store all perimeter stands, heated sampling lines and electrical cords.

   (e) Ensure that the standards are recapped and placed in the freezer.

   (f) Ensure that the agent log (Attachment 1) is completed for the day.

   (g) Ensure that the all Monitoring Data (Attachment 2) are completed and file the chromatograms for the day in the latest binder.

   (h) File scratch logs and data sheets in the appropriate binders

(i) Set up for the next day:

(1) Set up perimeter and personnel pumps. Make sure pumps/calibrators are charging.

(2) Prepare DAAMS tubes sets and field tags

(3) Condition used DAAMS tubes

(j) Collect all trash and dispose of in appropriate containers

(k) Make sure that all doors on the vehicle are locked (including the cab). Lock all cabinets and drawers in the RTAP.

(l) Make sure that the cellular phone is set on charge.

(m) Fill printer trays

(n) Make sure that all windows are closed and locked.

(o) Make sure that all heated sample line vacuum pumps are off.

NOTE: All calibration standards must be decontaminated before the RTAP leaves the site at the end of the operation.

APPENDIX B

OPERATION AND MAINTENANCE PROCEDURES

FOR

MINICAMS MOUNTED IN A MOBILE VEHICLE

Internal Operating Procedure: Operations Directorate

Monitoring Branch

Title: Operation and Maintenance Procedures for MINICAMS Mounted in a Mobile Vehicle

Division: Chemical Operations

Branch: Monitoring Branch

Building/Area: E3344 and other areas

This internal operating procedure covers operations, methods and procedures of a general nature not covered by a standing operating procedure. This procedure will be effective until rescinded or superseded.

Changes to this procedure will be accomplished by submission of revisions or amendments for approval.

Submitted by:

F. G. Lattin

Approved by:

F. G. Lattin
Chief, Monitoring Branch

Date: January 9, 1998

IOP Number: MT-16

Revision Number: 0

Prepared by: T. Roseberry
X4479

Approved by: F. G. Lattin
X4479

Title: Operation and Maintenance Procedures for MINICAMS Mounted in a Mobile Vehicle

Operator's Statement: I have read, or have had read to me the procedures in this IOP. I, by my signature below, indicate that I thoroughly understand and agree to abide by these instructions.

Signature	Date	Signature	Date

Supervisor's Statement: I have personally reviewed this IOP and, to the best of my knowledge, believe that the information listed herein is correct.

Supervisor: ______________________ **Date:** ______________________

F. G. Lattin

OPERATION AND MAINTENANCE PROCEDURES FOR MINICAMS MOUNTED IN A MOBILE VEHICLE

General Information

The MINICAMS can detect GB, GD, VX, XL or HD at either IDLH, TWA, or ASC levels. It is an automated gas chromatograph that first collects agent on a solid sorbent and then thermally desorbs the agent into a separation column for analysis. The components eluting from the column are detected by a flame-photometric detector or a halogen selective detector which respond to compounds containing either phosphorus (i.e., GB, GD and VX), sulfur (HD) or chlorine. Because of the low volatility of VX, a fluorinating filter must be used for the detection of VX. The filter converts VX to a more volatile compound (the G-analog of VX), which can be quantitatively transferred through the sampling and analysis system. XL is derivatized with EDT at the source. A direct readout, in units of the hazard level, is given on the front panel of the instrument. The MINICAMS requires environmental protection from extreme heat, cold, and dust to function properly.

The MINICAMS can detect agent in a filter stack, or in ambient air. The MINICAMS does not sample continuously because sampling is stopped during the thermal-desorption step. The MINICAMS sample during 80 to 85 percent of the total cycle time for TWA and ASC monitoring and 25 percent of the 2-min cycle time for IDLH monitoring. Advanced automatic agent monitoring instrumentation, such as the MINICAMS, is provided with internal diagnostics to determine the operability of the system. The MINICAMS software checks various parameters (e.g., temperatures, flow rates, etc.) to determine whether these parameters are outside preset limits. If outside these limits, an error message appears on the front panel, a yellow light flashes, and a malfunction status signal is sent to the control center.

While operating on generator power, each operating MINICAMS unit shall be calibrated and challenged with a QP challenge before deployment to the site and every operational workday. The first step in this procedure is to verify that the MINICAMS is operating correctly. Check the display screen to ensure that there are no errors. Page through the readouts and verify the preset readings are correct and displaying the expected response and that major parameters are within correct limits. Appropriate action shall be taken to correct any malfunctions found. In addition to the daily check of operating parameters made by the operator, software within MINICAMS automatically checks and corrects a number of internal parameters every 0.1 sec. These parameters include the temperature of the solid sorbent during sampling and desorption; and the temperatures of the detector and column. The generators should be running and unplugged from shore power.

After completion of the instrument observation, the instrument shall be calibrated and a QP challenge shall be made through the heated sampling line. The flow rates shall also be checked. The results of this QP challenge shall be recorded (see MBFORM-4, attached) as the first QP challenge of the day. The flow rate checks will be recorded in the Comments section of the form.

During a challenge or calibration operation, a QC standard solution of the agent of interest is injected into the heated sampling line. The concentration of the standard solution shall be such that the injection contains 1.0 ± 10% TWA, ASC, or IDLH of the agent depending on the hazard level the MINICAMS is programmed to detect. Proceed to calibrate the MINICAMS unit. After calibration is completed, rechallenge the instrument with a QP sample to verify the calibration. If the QP response is not within ± 25% of the target concentration, verify that the instrument is operating correctly, make any necessary adjustments, and rechallenge or recalibrate the instrument. Should a successive QP for that day fail to meet the ± 25% criteria, rechallenge the unit. If acceptable, the unit is in control, if not, it must be recalibrated and the above procedures applied. See exception paragraph 4.8.2.3. of the Monitoring Branch QC Plan. If the heated sampling line is used for XL, prior to calibration, a conditioning injection is needed due to the EDT coating.

The MINICAMS unit shall be calibrated according to the instructions given in the instrument manual. Calibration information is printed out on the "hard copy" printout from the MINICAMS.

Recertification of Existing Instruments.

Instruments that have undergone extensive repair or have stood idle for longer than six (6) months require recertification. Such instruments will be recertified by calibrating the instrument IAW manufacturing requirements. If all the responses fall between 0.75 and 1.25 TWA the instrument is considered to be calibrated and in control. If the four readings are not within the above window, recalibrate and repeat the above. If the instrument is still not within acceptable results, rerun P&A data.

Real-Time Monitoring.

The MINICAMS system is currently installed in all RTAPs used for real time monitoring at various sites throughout the Continental United States.

MINICAMS Monitoring Concept.

To provide real time chemical agent exposure information to site workers involved in remediation operations. Each system is challenged and recalibrated, if necessary, at the beginning of each operational day. Continuous monitoring is achieved through the use of a heated sampling line. The sample is drawn through the line into the MINICAMS units which desorbs and analyzes the sample during the 2 minute cycle time. The data collected from each MINICAMS are stored on a floppy disk and/or on a hard copy printout. This serves as a historical record of (no) agent release.

Data Evaluation.

Definition of the Presence of Chemical Agent.

327 340

The performance of the MINICAMS is monitored on a daily basis by a member of the sampling team. Each workday a 1 TWA challenge is made to the MINICAMS using a standard of known concentration to assure that the MINICAMS is operating correctly. Injection and calibration information is printed out on a hard copy which records the date, area, peak height, retention time, peak width, and injection size. This hard copy is initialed by the operator.

Hard copy reports from MINICAMS which use the "MINI-LINK" system will contain copies of the chromatographs and other pertinent information in addition to all the injection and calibration information listed above.

During mobile operations, chemical agent is defined as present if detected by the MINICAMS in a concentration greater than or equal to the 1 TWA level for three consecutive cycles.

Control Samples.

The MINICAMS is challenged daily with standard solutions of chemical agent at concentrations which will give readings of 1 TWA, when the instrument is functioning properly.

A MINICAMS sample is defined as the volume of air which is sampled during one automatic cycle of the instrument for the agent being monitored. To prepare a challenge sample for a MINICAMS, a known volume of standard dilute chemical agent see (Table No 3, paragraph 4.21, of the Monitoring Branch QC Plan) is injected into the heated sampling line during the sample period of the MINICAMS cycle. MINICAMS in the VX mode will have injections made at the fluoride conversion pad.

A record of the test date, time, flow rate and result will be maintained for each sample line (see MBFORM-4 attached to this IOP). Flow rate checks will be recorded in the "Comments" section of the form. This record will be maintained in the RTAP in which MINICAMS and the sample line is connected or in a safe and secure location that is easily accessible. The data are transported back to the Monitoring Branch for final documentation review and storage.

Hard Copy Printout.

All challenges of chemical agent monitors will be recorded on the hard copy printout. This hard copy printout and the strip chart records printout (where available) will be annotated with the pertinent information and initialed by the operator. Pertinent information for all challenges for operations which require more than one daily agent challenge will be printed out on hard copy. The data are also stored on the hard drive of the MINICAMS computer and are archived for subsequent storage.

Minimum Preventive Maintenance Procedures.

When challenging an instrument:

a. Verify that the unit is in the correct agent and concentration mode.

b. Verify that the unit is in the run (not calibrate) mode.

c. Verify that the recorder power switch is on (if applicable).

d. Verify that the alarm lamp, and horn come on when the MINICAMS is challenged.

e. Verify that no error message appears on the display.

f. Verify that each compressed-gas cylinder contains at least 100 psig. If not, change the cylinder. If monitoring for XL, verify that the EDT is at 30 psi.

g. Check the amount of printer paper remaining. Replenish, if necessary.

As Needed:

a. Replace the Pre-Concentrator Tube (PCT) weekly.

b. Check the external gas lines and fittings for leaks.

c. Measure the sample flow through the PCT before deployment and daily at the sampling site before and after calibration. It should be correct for the sampling application. Adjust the flow rate if necessary. Flow rates will be recorded on the Comments section of QC form (MBFORM-4) attached.

Instrument Certification.

The instrument shall be accorded certification if the pooled challenge results meet the following criteria. For Class 1 methods and monitors, at least 95% of challenges fall within +25% of the TWA value.

327 342

TAB

Appendix 6

APPENDIX G
TEU SOP

327 344

DEPARTMENT OF THE ARMY
HUNTSVILLE CENTER, CORPS OF ENGINEERS
P.O. BOX 1600
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO
ATTENTION OF:

CEHNC-OE-DC (200-1c) 30 January 1998

MEMORANDUM FOR Commander, U.S. Army Technical Escort Unit, ATTN: SMCTE-OP, Mr. Talley, Aberdeen Proving Ground, MD 21010-5423

SUBJECT: Scope of Work for Technical Escort Service at Defense Depot, Memphis, Tennessee

1. The U.S. Army Engineering and Support Center, Huntsville (USAESCH), requests that Technical Escort Unit (TEU) provide the following support:

a. Prepare and submit an operation plan in draft form by 6 March 1998, for continuous monitoring operations.

b. Provide personnel and equipment to conduct real-time monitoring for chemical warfare material (CWM) at the drill site hole.

c. Provide qualified person and equipment to operate D2PC and weather pack.

d. Provide technical assistance and advice to USAESCH contractors during drilling operations to mitigate further spread of hazards.

e. Provide a single round container and associated tools and packing materials for two members of your team to assess and package any chemical agent identification set vials or CWM that occur during the drilling operation.

f. Provide documentation that all on-site TEU personnel have received training and a medical examination in accordance with Safety and Health Plan.

2. Prepare and submit an after-action report to this office within 14 working days of project completion.

3. It is requested that you submit a cost estimate for this project to this office within 14 working days of receipt of this letter.

CEHNC-OE-DC 30 January 1998
SUBJECT: Scope of Work for Technical Escort Service at Defense Depot, Memphis, Tennessee

4. The project is scheduled to commence on or about 30 March 1998, and will continue for approximately one to two weeks. The requirement for TEU is expected to last the duration of the project.

5. If you have any questions pertaining to this request, please contact Mr. Steve Dunn, Project Manager, at 205-895-1144, or DSN 760-1144.

FOR THE DIRECTOR OF ORDNANCE
AND EXPLOSIVES TEAM:

ROBERT NORE, P.E.
Manager, Design Center for
Ordnance and Explosives Team

327 346

U.S. ARMY TECHNICAL ESCORT UNIT
STANDARD OPERATING PROCEDURE FOR:

OPERATION: MINICAMS®

ORGANIZATION SYMBOL: SCBTE-MAT

SOP NUMBER: TU-0000-M-015 **DATE:** 17 February 1998

PREPARED BY: ____________________ **TITLE:** Chemist
Andrew L. Wolf

REVIEWED BY: ____________________ **TITLE:** Physical Science Tech.
Jack Lowery

CONCURRENCE:

OFFICE	SIGNATURE	TITLE
TEU S-4	Capt. Forte Ward	S-4
TEU S-3	Dalys Talley	S-3
TEU S-1	Eileen Miller	Adjutant

APPROVAL: ____________________ ____________________
Douglas J. Norton DATE
LTC, CM
Commanding

327 347

STANDING OPERATING PROCEDURES
MINICAMS®
SOP No. TU-0000-M-015

SUPERVISOR'S STATEMENT: I have personally reviewed this SOP and to the best of my knowledge believe that the information listed herein is correct.. I, by my signature attest that the operators who have signed this SOP have received the required instruction. I understand and am fully capable of performing my responsibilities.

SIGNATURE	DATE	SIGNATURE	DATE

327 348

STANDING OPERATING PROCEDURES
MINICAMS®
SOP No. TU-0000-M-015

OPERATOR'S STATEMENT: I have read the general and specific requirements of this SOP. I, by my signature below, indicate that I thoroughly understand and agree to abide by these instructions. I understand that I am fully capable of performing my responsibilities as delineated within this SOP.

SIGNATURE	DATE	SIGNATURE	DATE

327 349

DEPARTMENT OF THE ARMY
U.S. ARMY TECHNICAL ESCORT UNIT
ABERDEEN PROVING GROUND, MARYLAND 21010-5423

TEU SOP No.
TU-0000-M-015

Standing Operating Procedures
MINICAMS®

TABLE OF CONTENTS

327 350

TABLE OF CONTENTS

Chapter 1 - GENERAL

1.1 PURPOSE. The purpose of this SOP is to establish certification requirements and mandatory safety practices for the MINICAMS®.

1.2 RESPONSIBILITIES.

a. S-3 will coordinate with contractors and/ or others as applicable, for initial MINICAMS® training of TEU personnel.

b. The TEU Monitoring Branch will coordinate with the ERDEC Monitoring Branch for Precision & Accuracy certification of operators and instruments.

c. Company Commanders at Pine Bluff Arsenal and Dugway Proving Grounds will arrange for P & A certification IAW with the CQAPCAAM Plan, through the local monitoring branch.

d. Company Commanders or wage grade supervisor will ensure that operators maintain certification in accordance with this SOP.

e. Project Officer In Charge (OIC) shall ensure that operators comply with the procedures outlined in this SOP.

f. Operators at completion of a project will archive all MINICAMS® data using the MINILINK® software for that specific project and will download the data to disk(s) and will transfer the disk(s) to the chemist or a representative of the TEU Monitoring Branch for storage. All MINICAMS® data and log books will be stored by the TEU Monitoring Branch.

327 352

Chapter 2 - CERTIFICATION

2.1 OPERATOR CERTIFICATION REQUIREMENTS. Only certified individuals will operate TEU MINICAMS®. Certification consists of initial training and certification testing.

2.2 INITIAL TRAINING. Operators obtain initial training by attending a 40-hour MINICAMS® Flame Photometric Detector (FPD) course and 24 hour Halogen Selective Detector (XSD) for HD and L, normally provided by the CMS Research Corporation. Operators must demonstrate proficiency in the following areas:

(a) Principles of MINICAMS® operations.

(b) Operation of the heated sample line.

(c) Selection of the gas flows and pressures.

(d) Selection of the agent parameters.

(e) Injection techniques.

(f) Operation of the strip chart recorder.

(g) Calibration procedures.

(h) Replacement of the PCT or reactor tube and gas cylinders, including EDT gases for L.

(i) Operation of the controller.

(j) Identification of leaks, flameout, and low sensitivities.

2.3 CERTIFICATION TESTING. Certification testing will be IAW the TEU QC Plan. The test will consist of the following:

a. Twice, for 2 successive days, each operator will challenge a MINICAMS® with a set of challenge injections for each agent for which the MINICAMS® will be certified (i.e., HD, L VX, GB, or GD).

b. The challenge injections consist of one injection at 0.5 TWA, one at 1.0 TWA, and one at 1.5 TWA.

c. Certification testing will only be conducted on a P & A certified MINICAMS®.

2.4 OPERATOR RE-CERTIFICATION REQUIREMENTS.

a. To maintain certification, operators must calibrate and challenge a MINICAMS® at least once every 60 calendar days.

b. Previously certified operators who do not calibrate or challenge a MINICAMS® at least once in a 60-day period must perform the following, under the supervision of a certified operator:

(1) Read the MINICAMS® SOP and document that they read and understood it.

(2) Perform calibration procedures.

(3) Duplicate samples of 0.5 TWA, 1.0 TWA, and 1.5 TWA.

c. Personnel who do not calibrate or challenge a MINICAMS® for a period of 6 continuous months must undergo certification testing IAW paragraph 2.3 above.

2.5 INSTRUMENT CERTIFICATION. Instrument certification will be accomplished IAW QAPCAAM Plan.

2.6 INSTRUMENT RE-CERTIFICATION. Instrument re-certification will be accomplished IAW QAPCAAM Plan.

327 354

Chapter 3 - SPECIFIC INFORMATION

3.1 STANDARDS.

a. TEU will normally use dilute standards having the following concentrations: HD - 1.8 ng/μl; GB - 0.2 ng/μl; GD - 0.07 ng/μl; VX - 0.2 ng/μl; and L - 1.7 ng/μl.

b. The recommended standard solutions are based on the following equation:

$$ng/\mu L = \text{TWA Conc.} \ X \ (\text{cycle Time} - 2) \ X \ 1000 \ ml/min \ X \ 1/\text{vol injected}$$

3.2 CALIBRATION.

a. Operators must check the MINICAMS® daily, prior to operations, to determine if they must conduct a calibration.

b. Before operations, the operator must calibrate any MINICAMS® which was not left operating from the previous day.

3.2.1 COLD START UP CALIBRATION

a. 3-4 calibrations must be made at 1 TWA (4 μL)

b. After calibration is completed a .25 TWA injection (1.25 μL) must be made IAW CQAPCAAM.

c. Challenge at 0.25 TWA should equal +/- 50% of the .25 TWA limit which is 0.13 - 0.37 TWA.

d. Upon successful completion of the 0.25 TWA injection, operators must print and sign the parameter sheet.

e. The operator will make calibration injections at the end of the heated sample line or the reactor for L during sampling operations. If the operator is not using the instrument for sampling, he/she may make the injections at the instrument.

f. Operators will record the standard vial ID number used for calibration in the log book.

NOTE: This is the only time a .25 TWA injection will be made in the field.

327 355

3.2.2 SUSTAINED OPERATIONS IN STANDBY MODE

a. If the MINICAMS® is already in operation from the previous day, perform the following:

(1) Check the screen to verify that there are no malfunction errors.

(2) Verify that preset readings are correct and displaying the expected response.

(3) Verify that major parameters are within correct limits.

(4) If the 1.0 TWA challenge is successful (0.75 - 1.25), calibration is not required.

b. If calibration is necessary, calibrate the MINICAMS® using a "spike" sample.

c. The operator will make calibration injections at the end of the heated sample line for sampling operations. If the operator is not using the instrument for sampling, he/she may make the injections at the instrument.

d. Operators will record the standard vial ID number used for calibration in the log book.

Chapter 4 - CHALLENGING

4.1 CHALLENGING IN THE FIELD.

a. When operating in the field, operators will challenge the MINICAMS® at the end of the sample line. The challenge for VX will be at the V to G conversion pad and at the reactor for L.

b. Operators shall successfully challenge the MINICAMS® once before operations, and every 4 hours thereafter, during continuous operations. Down range personnel will cease work while the MINICAMS® Operator conducts these challenges. Challenges will consist of one TWA (4 μL) concentration amount of HD, L, VX, and G series. The operator will challenge the instrument during the sample period.

c. If the response is not within +/- 25% of the target response (0.75 - 1.25 TWA), the operator will re-challenge the MINICAMS®.

d. The operator will re-calibrate the instrument after two successive challenge failures. The operator shall annotate the performance chart.

e. Operators will record all MINICAMS® challenges in the logbook.

f. Operators will challenge the MINICAMS® with the same dilute agent concentration as they used for calibration.

4.2 CHALLENGING FOR G-SERIES, VX, HD, AND L.

a. Press the "PAGE" button until the main page is displayed.

b. Press the "PARAM" button until the lower left corner of the LCD is flashing.

c. Press the "PARAM" button until "CHK" is blinking, press "ENTER." This is the check mode, more commonly referred to as the challenge mode.

d. When the word "INJECT" appears on the screen, inject the dilute standard.

e. Wait for the TWA concentration to appear on the LCD. The MINICAMS® should alarm. The TWA concentration should be between 0.75 and 1.25.

f. If the concentration is not within the +/- 25% then repeat steps in paragraphs d and e.

g. If the MINICAMS® fails two successive challenges, re-calibrate the instrument.

h. If the MINICAMS® passes either the first or the second challenge, it is ready for monitoring.

327 358

Chapter 5 - OPERATION REQUIREMENTS

5.1 STANDBY MODE AND SHUT-DOWN PROCEDURES.

a. Perform an end of operations challenge of the MINICAMS®. If MINICAMS® is out-of-control after the second end of operations challenge, record the data in the Agent Monitor Sample Log and continue with the shut down.

b. During shutdown procedures turn off the hydrogen, compressed air, nitrogen, EDT gas (if necessary), sample pump, printer, and the disk drive.

c. During standby mode leave the MINICAMS® monitor on and allow the nitrogen to run through it. Reduce the nitrogen to 10 psig in the standby mode.

5.2 DOCUMENTATION REQUIRED.

a. Operators shall perform/maintain the following documentation each time they use the MINICAMS®.

(1) The Instrument Logbook.

(2) Print outs.

(3) Save MINICAMS® output onto a disk or onto the MINILINK® system.

b. All entries must be legible and made with indelible ink.

5.3 OUT OF CONTROL SITUATIONS.

a. An out of control situation occurs when a challenge response is outside the performance bounds (i.e., less than 0.75 or greater than 1.25 TWA) for two successive failures.

b. In the event of an out of control situation, the operator will take immediate corrective action. They will then annotate their actions in the remarks column of the record book.

Chapter 6 - MONITORING/SAMPLING

6.1 GENERAL. Sampling/monitoring will take place only after the operator completes agent setup; calibration; and successful challenge.

6.2 SAMPLE SCREENING.

a. Heat samples to over 70 degrees F.

b. Sample the vapor that is trapped above the solid samples for one complete cycle.

c. Do not clear the sample if the MINICAMS® alarms. Notify the OIC or the point of contact.

6.3 PROCEDURE FOR CLEARING MATERIALS.

a. Place the material in a container that can contain vapors and heat to 70 degrees F.

b. Sample the air inside the container with the MINICAMS® for at least one complete cycle.

c. Do not clear the item if the MINICAMS® alarms. Notify the OIC or the point of contact.

d. Begin sample verification utilizing the Depot Area Air Monitoring System (DAAMS) or Draeger tubes.

327 360

Chapter 7 - USE OF DILUTE STANDARDS

7.1 STORAGE OF DILUTE STANDARDS.

a. TEU will store dilute standards at or below 4 degrees Centigrade. Operators will document any temperature changes greater than 10 degrees.

b. Secure dilute standards in a locked refrigerator during non-operational periods. During operational periods, when the standards are present and the refrigerator is unattended, the refrigerator will also be locked.

c. While in a field environment and if a refrigerator is unavailable, maintain the standards on ice in a suitable container that is kept under control and surveillance.

d. When removing standards from storage for use, allow the vial to equilibrate to ambient temperatures before use.

e. Before replacing the vial into storage, operators will recap and re-crimp as necessary to delay evaporation of the agent standards.

f. Dilute nerve, mustard, and lewisite standards have a shelf-life of months. Operators will not use standards beyond the shelf life.

7.2 TRANSPORTATION.

a. Over-pack dilute agent solutions in a leak-proof container with absorbent and cushioning material, restraining from tipping, falling over, or rolling around.

b. Transport RDTE dilute solutions IAW AR 50-6, sec 9-3.

7.3 ACCOUNTABILITY AND CONTROL.

a. Log all dilute standards on a DA Form 1911.

b. Operators will not perform the duties of agent custodian at the same time they are responsible for operating the instrument.

c. Individuals designated as agent custodians shall control access to the dilute solutions, and maintain the Custodial Log.

d. Record the destruction of dilute standards on the Record of Destruction (Table 7-1).

Table 7-1 Record of Destruction

SCBTE-MAT
DATE:__________

MEMORANDOM FOR RECORD

SUBJECT:RECORD OF DESTRUCTION

1.The following items have been destroyed IAW current directives. The resulting waste material has been disposed of by approved procedures:

Item No.	Container No.	Description	Quantity

__________________ __________________
CUSTODIAN WITNESS

2.POC for this action is the undersigned at 5-4432.

Andrew Wolf
Chemist
TEU Monitoring Branch

7.4 DISPOSITION OF EXCESS/UNUSED DILUTE AGENT SOLUTION.

a. Return unused standards to the TEU Monitoring Branch, if used on APG or a short off-post mission; or destroy them on-site, if used on an off-post mission.

b. Destroy dilute standards by pouring the remaining quantity in the appropriate decontaminating solution. Decontaminating solution consists of 1 gallon (3.79L) of bleach for every 50 vials of standard.

c. Place empty vials and the septum caps in the decontaminating solution.

d. Handle the resulting solution as hazardous waste.

e. The equation for calculating the amount of decontamination solution to amount of dilute (drinking water level) standards is:

(1 ml standard/0.034 oz decon) X 0.4267 = 12.5 1.5 ml vials

This equation uses 64 ounces of 5-6% household bleach as the decon agent at a ratio of 100:1 decon: standard. Variable amounts of decon agent adjusts the equation accordingly. For example, 1 gallon (128 oz) of 5-6% bleach decon, 25 1.5 ml vials of standard.

Chapter 8 - PROTECTIVE ACTION REQUIREMENTS

8.1 PROTECTIVE CLOTHING AND EQUIPMENT. Determine the level of protection through the site SOP.

8.2 EMERGENCY ACTION PROCEDURES.

a. If the MINICAMS® alarms, don protective mask, sound the alarm, and evacuate the area in accordance with the site SOP.

b. Cease operations whenever the MINICAMS® response to a challenge is less than 0.75 TWA or greater than 1.25 TWA.

c. Record any alarms in the MINICAMS® logbook, investigate, and take corrective action.

d. Notify OIC to begin confirmation samples within 20 minutes.

Chapter 9 - COMPRESSED GASES

9.1 TRANSPORTING GAS CYLINDERS.

a. Do not transport gas cylinders through tunnels.

b. Carry fire fighting instructions with personnel transporting gas cylinders.

c. Carry fire extinguisher inside vehicles transporting compressed gases.

d. Secure cylinders to prevent movement during transport.

e. Placard vehicles transporting compressed gas cylinders IAW CFR 49.

9.2 STORAGE AND HANDLING OF GAS CYLINDERS.

a. Do not use safety devices in valves or cylinders without reducing the pressure through a regulator specifically designed for that purpose.

b. When installing a regulator, exercise particular care to assure that the threads on the regulator or union are the same as those on the valve.

c. For storage and handling purposes, always consider all cylinders full.

d. Never drop or allow any object to strike a cylinder.

e. When standing cylinders upright during storage, take precautions to prevent accidental falls or movement.

f. Never lift a cylinder by grasping the valve or valve protection cap.

g. Never lift cylinders by slings or electromagnets.

h. Never utilize cylinders as rollers or supports.

i. Do not store cylinders by heat sources or where temperatures are in excess of 130 degrees F.

j. Prohibit smoking within 50 feet of compressed flammable gas storage.

k. Store empty and full cylinders separately.

327 365

9.3 GAS USAGE.

a. To calculate the number of 80 FT cylinder sets needed to run a MINICAMS® at a rate of 10 hours a day, use the following information:

(1) One set of gas cylinders lasts approximately 20 days.

(2) $\frac{\text{Length of project (Days)}}{20}$ = No. of sets of gases

b. Round up to whole numbers.

c. The gas usage for a 20 ft^3 cylinder of EDT at 8 hours per day the cylinder can be used for 20 days before needing to be changed.

NOTE: To order EDT gas cylinders takes approximately 30 days. This needs to be taken into consideration when going on a long term mission.

d. The above calculation (2) can be used to calculate how many EDT cylinders need to be taken on a particular project. Reminder the usage is based on 8 hours per day not 10 hours per day like the other gas cylinders.

327 366

Chapter 10 - MINICAMS® EQUIPMENT

10.1 EQUIPMENT SELECTION.

10.1.1 SELECTION OF PRECONCENTRATOR TUBES THE MINICAMS® USES. The MINICAMS® uses three types of preconcentrator tubes, HayeSep D and Tenax, short bed or long bed. Use Tenax (long or short bed depending of operation) for monitoring HD and L and use HayeSep D for monitoring nerve agents such as VX, GB, and GD.

10.1.2 OPTICAL FILTERS. The MINICAMS® uses two types of optical filters to monitor for mustard and nerve agents. Use the violet sulfur filter to monitor for HD. Use the yellow-green phosphorous filter to monitor for VX, GB, and GD.

10.1.3 V TO G CONVERSION PADS. Use the V to G conversion pads to convert VX to the G analog using silver nitrate. Ensure that the darkest side of the pad is facing out towards the sample point when installing the pad. The shelf-life of these pads is 6 months; do not use any V to G pads which exceed this period.

10.2 MINICAMS® ESSENTIAL COMPONENTS LIST.

a. The TEU Monitoring Branch will issue the following items when a company requests a MINICAMS®:

(1) MINICAMS®, Field Model w/ built-in controller	1 ea
(2) MINILINK® computer	1 ea.
(3) Linear Mass Flowmeter	1 ea.
(4) Printer	1 ea.
(5) Sample Pump	1 ea
(5) Heated Sample Line w/ Bottle	1 ea
(6) Optical Filter (S and P)	1 ea.
(7) Power Strip	1 ea
(8) Line Conditioner	1 ea
(9) Gas Purification Kits	3 ea
(10) Instrument Log	1 ea

b. The TEU Monitoring Branch will issue the following items when a company requests a XSD MINICAMS®. The above items with the addition of the following items:

(1) XSD Controller	1 ea
(2) MINICAMS® signal cable	1 ea
(3) Probe signal cable	1 ea
(4) XSD Start-up kit	1 ea
(5) Power cord	1 ea
(6) Lewisite probe and shield	1 ea
(7) Probe controller	1 ea
(8) EDT Regulator	1 ea
(9) Lewisite Controller/Probe Interface cable	1 ea
(10) Lewisite Controller/MINICAMS® Interface cable	1 ea
(11) Lewisite Reactor Tubes	2 ea
(12) Lewisite PCT tubes	2 ea
(13) Lewisite detection manual	1 ea

c. The following expendable items are required in the quantities listed to operate the MINICAMS® for 30 days:

(1) Recorder Paper	10 ea
(2) Recorder Pens, Black and Red	2 ea
(3) Printer Ink Cartridge	3 ea
(4) 10 μl Syringes	3 ea
(5) V to G Conversion Pads	50 ea
(6) Dust Filters	50 ea
(7) Teflon Tubing 1/8" OD	20 ft
(8) Ferrule 1/8" SS (FR & BA)	10 ea
(9) IPA, small bottle	1 ea
(10) Printer Paper	1 box
(11) Teflon Tape	1 rol
(12) SNOOP	1 Bot
(13) Record Books	1 ea
(14) Agent Monitor Sample Log	1 ea
(15) Expendable Supply Kit	1 ea
(16) Compressed Gases 80 ft^3 (N, H, Air)	3 ea
(17) EDT Compressed Gases 20 ft^3	2 ea
(18) Permanent Black Markers	5 ea
(19) Labels	1 box

d. Companies must specifically request the following optional items:

(1) Dilute agent standards
(2) Generators – this will be supplied by the Chemical Equipment Room (CER) when requested.
(3) Fuel cans – this will be supplied by the CER when requested.
(4) Grounding rods – this will be supplied by the CER when requested.
(5) Strip chart recorder
(6) Floppy disk drive (TEU Monitoring Branch does not supply disks)
(7) Decapper & crimper

10.3 MINICAMS® TRANSPORTATION.

a. Transport the MINICAMS® in the carrying case whenever possible.

b. When the MINICAMS® is mounted in a vehicle, secure the printer, strip chart recorder, and gases to prevent movement.

10.4 MINICAMS® MAINTENANCE.

a. MINICAMS® maintenance will be IAW with manufacturers' specifications.

b. Trained and certified operators may perform operator level maintenance as described below:

OPERATORS:

(1) Change PCT and tighten anchor nut

(2) Clean and tighten electronic check valve

(3) Change dust filters and V to G conversion pads or reactor tubes for Lewisite

327 369

OPERATORS/ MAINTENANCE TECHNICIANS

(1) Identify and repair any nitrogen, hydrogen, air, or EDT leaks within the monitoring setup.

(2) Make necessary adjustments to the operating parameters for a given method (TWAH, TWAG, TWAL). These adjustments would be for parameters that are not ordinarily changed by the operator (agent gate, PMT voltage, sample flow).

(3) Remove broken PCT's and resulting debris from the instrument.

(4) Interpret recurring error codes and determine what repair steps are needed.

(5) Perform preventive maintenance (flush the column, perform leak checks, electrical checks and verify the Electrometer alignment).

(6) Troubleshoot and repair any instrument malfunction,.electrical or mechanical. This includes replacing IC's relays and heaters.

Attendance of the maintenance course does not make the operator an expert on the MINICAMS®. It only gives them the knowledge to understand the instrument operation. Hands on experience is required for anyone to become an expert and even with extensive hands on experience, outside assistance is sometimes required. TEU maintenance technicians will contact the CMS Field representative for appropriate guidance as necessary.

c. All maintenance performed will be recorded in the MINICAMS® Operator Logbook.

10.5 <u>HEAT TRACED SAMPLE LINES.</u>

TEU will not use heat trace sample lines until challenged IAW the CQAPCAAM Plan.

ANNEX A - REFERENCE PUBLICATIONS

MINICAMS® FM 3000 OPERATORS MANUAL

AR 50-6, Chemical Surety

CASARM QA PLAN

TEU QA/QC PLAN

TEU DAAMS SOP

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE