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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

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DDMT.IRM
MAY '91.

ANNEX B
RI/FS FOLLOW ON INVESTIGATION
AND
INTERIM REMEDIAL MEASURE
FOR CONTAMINATED GROUNDWATER
AT DEFENSE DEPOT, MEMPHIS

1.0 GENERAL STATEMENT OF SERVICES

1.1 Background. As a result of the Remedial Investigation/Feasibility Study (RI/FS) that was performed at Defense Depot Memphis, Tennessee (DDMT) in 1990 (Refs. 10.8 and 10.9), it has been determined that the upper aquifer underlying the installation has been adversely affected by past waste management practices at the Installation, and that a contaminated plume of groundwater extends beyond the western boundary of DDMT. This aquifer is not used for domestic consumption by the community, however, some researchers believe that there may be a vertical connection between this upper aquifer and the Memphis Sand Aquifer from which the city of Memphis gets its domestic water supply. The studies that have been performed at DDMT to date, have not been successful in locating any vertical connection between the aquifers. The full extent of the plume has not yet been determined. However, to meet the requirements of the Installation's RCRA Part B Permit and, in keeping with its policy of evaluating waste management practices at its installations, and where possible, remediating sites that have been adversely impacted, the Defense Logistic Agency (DLA) has decided to implement interim remedial actions to treat the contaminated groundwater at DDMT. The RI/FS was performed to meet the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Since then, some of the sites have been classified as Solid Waste Management Units (SWMUs) under 3004(u) of The Hazardous and Solid Waste Amendments (HSWA). Consequently, the interim remedial action and any additional field investigation implemented under this contract will be performed to fulfill the requirements of the EPA RCRA Permit. When the full extent of the plume has been determined, DLA will

coordinate with Federal, State and local authorities to agree on a permanent remedial action for the site. The US Army Corps of Engineers, Huntsville Division, on behalf of the Defense Logistic Agency, is contracting for the additional work to identify and delineate the contaminant sources, and prepare the contract documents for a service contract for the interim remedial actions to be conducted at Defense Depot, Memphis. The work will be conducted according to all applicable EPA and State of Tennessee statutes and regulatory guidance.

1.2 Location. DDMT consists of 642 acres of Federal land located one mile north of Memphis International Airport, Shelby County, Tennessee. The Installation is located in the City of Memphis, and is surrounded by a mixture of both residential and Commercial land uses.

1.3 Previous Investigations. Several investigations have been conducted at the Installation. They were, however, conducted to support specific management objectives. To date, the most complete investigation performed at DDMT has been the RI/FS mentioned above. This investigation was conducted by Law Environmental, Government Services Division under a contract with the Huntsville Division of the US Army Corps of Engineers, and lists all previous studies that were conducted at DDMT. The report concluded that groundwater underlying the western portion of the Installation was contaminated with organics, and that additional investigations were necessary to fully delineate the extent of the contaminated plume. Additional investigations would also be needed to identify all the potential sources of contamination to the groundwater, and sources of contaminants that may be reaching the sediments in both Lake Danielson and the golf course pond. It is on the basis of this RI/FS that this RI/FS Follow-On Investigation and Interim Remedial Measure are being initiated.

2.0 OBJECTIVE

The objective of this contract is for the AE to : 1) Coordinate the Solid Waste Management Unit in the EPA RFA Report (Ref.10.22) with the areas investigated in the previous RI/FS Study and identify the units from which releases are/are not being generated. 2) Perform additional field investigations to fully delineate the groundwater plume, locate previously

unidentified burial sites, characterize soil contamination, and identify the sources from which contaminants are migrating to the sediments in Lake Danielson and the golf course pond. 3) Prepare Section C-Conceptual Design/ Specifications/Work Statement for a services contract for an interim remedial measure for contaminated groundwater at DDMT. An option is included in the contract for the AE to prepare the Proposed Plan and Record of Decision (ROD) documents, if required by the Contracting Officer. The purpose of the interim treatment system is to mitigate off-site migration of contaminants and to treat, on an interim basis, groundwater contaminated with organics and metals to below EPA and State of Tennessee action levels. Actual construction and operation of the treatment system is not a part of this contract. The AE shall propose an acceptable method for the disposal of treated water that may be generated from the remedial activities. If the option for the ROD is exercised, the Proposed Plan and Record of Decision shall be presented as separate Documents. Another objective of this contract is to prepare data items DD1493, DD1664, Standard Form 36 and a detailed cost estimate for the work included in the Section C Work Statement.

3.0 DETAILED DESCRIPTION OF SERVICES

The AE shall be responsible for performance of all work described in this contract. The AE shall prosecute the work under the direction of a responsible representative approved by the Contracting Officer. The representative shall be designated as the AE Project Manager for this project and shall oversee the correlation of the entire project, administer all instructions and answer all questions from this office pertaining to the project during the life of the contract. The AE Project Manager shall be responsible for the completion and coordination of all work developed under this contract. Work shall be completed with adequate internal controls and review procedures which will implement the requirements of this contract. All work shall be performed under the supervision of a Professional Engineer registered in the State of Tennessee and a Certified Professional Geologist, and in accordance with this Statement of Work (SOW) as follows:

3.1 Field Investigations and Report

This subsection details the requirements of the field work necessary

to gather additional data to further characterize the site and delineate the groundwater plume in order to select a comprehensive remedial action. The AE shall apply the results of the completed field investigations to complete the data gaps and expand upon the findings of the RI/FS Report (Refs. 10.8 and 10.9). All work performed by the AE shall, so far as possible, be designed and implemented in a manner to compliment the RI/FS Report and shall conform to the approved Field Investigation Plan and this Statement of Work. When all the field work and data analyses are complete, the AE shall submit to the Huntsville Division a RI/FS Follow-On Report detailing activities, results, and conclusions, along with recommendations for any additional work that may be necessary to complete the Remedial Design. The Field Investigation Plan and reports shall present a complete description of the AE's efforts from planning through completion of the RI/FS Follow-On Report.

3.1.1. (Task 1) Site Visit and Field Investigation Plan. Along with a site visit, the AE shall use information gathered from the RI/FS Report, the RI/FS Work Plans, the State's and EPA's comments on the RI/FS Report, EPA's RFA Report and the RCRA Part B Permit to develop a Field Investigation Plan for the follow-on work. The Plan will be submitted by the Government to the Regulators for approval. It shall be written as an addendum to the existing RI/FS Work Plan and shall be compatible with the RI/FS work, this Statement of Work, the RCRA Permit, State of Tennessee and USEPA guidance/regulation and Army regulations. Quality Control/ Quality Assurance procedures, Standard Operating Procedures, methods, equipment, and specific personnel that the AE proposes to use for each task shall be discussed at appropriate locations within the plan. Each proposed method, procedure, and technique must be specified in detail by reference to recognized and accepted publication with a description and justification given for each deviation from the published method. Sampling and analysis shall comply with methods and procedures in the EPA Region 4 RFI Work Plan outlined in Part II.F and Appendix B of the RCRA Permit. No field work other than the initial site inspection may be performed until the plans have been reviewed and approved by the Contracting Officer. The site visit shall last no longer than 3 days. For negotiation purposes, the AE shall assume that 3 people will perform the site visit. The Field Investigation Plan shall include as a minimum, the following:

3.1.1.1 Coordination of RFA SWMUs and RI/FS Sites The AE shall coordinate the SWMUs of the EPA RFA Report and the areas investigated for the RI/FS study . The AE shall use the RFA Report and the RI/FS Work Plans and Report to prepare a brief overview of each SWMU. The areas from which there is evidence of a release or the potential for a release shall be clearly identified. SWMUs that require no further study shall also be identified.

3.1.1.2 Safety and Health Plans The A-E shall develop and maintain a Health and Safety Program Plan in compliance with the requirements of OSHA Standard 29 CFR 1910.120 (b)(1) through (b)(4). Written certification that the health and safety program has been developed and implemented shall be submitted to the Contracting Officer and shall be made available upon request. The A-E shall prepare and submit a Site Safety and Health Plan (SSHP) to the CO for review and approval prior to commencement of any field work. The SSHP shall be prepared in accordance with Section 5.0 of this SOW.

3.1.1.3 Soil Boring, Pump Test Well and Monitoring Well Installation Plan. The AE shall prepare and submit a work plan which accommodates the installation of stratigraphic soil borings,two pump test wells and associated ground water monitoring wells in both deep and shallow zones, according to the requirements of Sections 5,6 and 7 of this Statement of Work. The Work Plan shall meet the requirements of all applicable Federal, State, and County regulations. The objective of the pump test is to collect and analyze data from which the principal factors of the aquifer shall be calculated. Each pump test well shall utilize at least four wells as observation wells. As a minimum, the Plan shall include the identity and responsibilities of the AE's personnel working on the project and shall describe the method of drilling, drilling equipment and decontamination procedures that will be employed in all areas of DDMT. The method and technique used must prohibit the movement of water from one water-bearing stratum to another. The AE shall propose a suitable method of analysis for the pump test data. After completion of the stratigraphic borings, they shall be abandoned and completely grouted according to the requirements of the State of Tennessee. Copies of the boring and well logs shall be sent to the Huntsville Division within 10 working days from the completion of drilling. The AE shall propose and justify the choice of locations and depths of each monitoring well, pump test

well and stratigraphic boring. The AE shall identify each proposed location on a site map to be furnished by the Government. The AE shall propose methods to determine the classification of drill cuttings (hazardous waste/non-hazardous) and methods for disposal of the water collected from the pump test. Continuous air monitoring for volatile organics will be required during drilling. So as not to delay the IRM tasks, the Draft plans for the pump test may be submitted separately. The Final submittal shall be a part of the Final Field Investigation Plan.

3.1.1.4 Chemical Data Acquisition Plan (CDAP). The A-E shall prepare and submit a Plan for the collection and analysis of field data according to the requirements of Section 6 of this SOW, Section 4 of Reference 10.20 and Reference 10.21. The CDAP shall summarize all proposed sampling locations and analyses to be performed. The laboratory and field QC/QA plan shall be submitted as a part of the CDAP.

3.1.1.5 Geophysical Survey Plan. The AE shall prepare a Geophysical Survey Plan which proposes specific locations for geophysical investigations. It shall state specific justification for the method(s) and equipment selected at each site. The intention of the geophysical survey is to assist in the location of undocumented burial sites that may be serving as sources of contaminants to the groundwater, and to assist in the location of monitoring wells in areas not fully defined. All proposed geophysical methods shall be sufficient to locate a buried trench or pit 25 feet below the surface. The Plan shall also provide for the use of an appropriate surface geophysical method to survey soil boring and monitoring well locations prior to drilling, to ensure that there are no buried utilities or ordnance below the work site.

3.1.1.6 Data Management Plan. The AE shall prepare a Data Management Plan which describes how the work is to be implemented and managed. This plan shall serve as an overview of the total work, and describes the information expected from each task and how this information will be interpreted and incorporated into the final report.

3.1.1.7 Community Relations Plan. The AE shall prepare a plan to assist the Government in community affairs if this becomes necessary. The plan shall address the topics covered in (Ref. 10.19) Community Relations in Superfund: A Handbook, USEPA, Jan 1986. The AE shall provide guidance and

support in technical matters, as needed by Government, to inform the public and maintain clear channels of communications to the community. Community relations shall remain the responsibility of DDMT. The AE shall provide support at three meetings.

3.1.2 Field Investigations. The AE shall perform field investigations on or off the installation as appropriate, in order to determine the extent of the groundwater plume, characterize the aquifer, locate previously unidentified contaminant sources in Dunn Field, and locate sources of contaminants reaching the surface water bodies on the main installation. Drilling locations must be approved by the Contracting officer. The Government will coordinate with local authorities to obtain the necessary entry permits to drill off the installation. The AE is responsible for obtaining all other regulatory drilling permits. .

3.1.2.1 (Task 2) Geophysical Surveys. The AE shall perform at least thirty thousand (30,000) linear feet of geophysical survey at locations shown in the approved Geophysical Survey Plan, utilizing the methods of geophysical investigation capable of detecting buried trenches, pits, drums organic contaminants below the surface. The purpose of the geophysical surveys is to obtain detailed information necessary for source characterization. The AE shall utilize sufficient location control in the field to ensure that geophysical anomalies located are recoverable to an accuracy of plus or minus one foot. The AE shall perform all associated work and subsequent evaluations and interpretations necessary to incorporate the data into the Follow-On Report.

3.1.2.2 (Task 3) Install Stratigraphic Test Borings. The AE shall install five stratigraphic borings at five separate locations that have been shown in the approved work plan. These borings are to be used to provide stratigraphic information and samples for chemical analyses. Drilling and sampling methods shall meet the requirements of Sections 5, 6 and 7. No boring shall exceed 200 feet in depth. A total of 600 hundred (600) feet of drilling is provided for under this task.

3.1.2.3 (Task 4) Install Wells. The AE shall install twenty groundwater monitoring wells at twenty separate locations shown in the approved Field Investigation Plan. These wells are to monitor groundwater

quality in the fluvial aquifer and assist in the delineation of the contaminant plume A total of 2,000 feet of drilling is provided for under this Task. These wells shall be constructed in accordance with the requirements of the approved Work Plan and Section 7 of this Statement of Work.

3.1.2.4 (Task 5) Install Pump Wells. The AE shall install two 8-inch pump test wells. The wells shall be located so that each pump test well will be able to utilize at least four of the monitoring wells as observation wells. The depths, locations and proposed screened interval shall be proposed in the Work Plan. A maximum of 300 linear feet of drilling is provided for under this task. The AE shall obtain necessary permits prior to performing any drilling. The pump test wells shall be located so that they may be converted to either extraction or injection wells if they are needed in the remediation process.

3.1.2.5 (Task 6) Perform Pump Test. The AE shall provide all necessary equipment and personnel required to mobilize for, perform, and demobilize from the pump test for each of the two wells. The AE shall perform step-drawdown tests for a minimum of 10 hours to determine the optimum pumping rate of the well. The AE shall perform the pumping phase of the test for a minimum of 36 consecutive hours per well. The AE shall perform the subsequent recharge monitoring phase of the test for a minimum of 36 consecutive hours after the pumping phase is completed. The total field time of the tests shall be a minimum of 170 hours.

3.1.2.6 (Task 7) Pump Test Data Analysis. The AE shall evaluate the data collected during the pump test and provide a brief report describing the work performed and the interpretations of the data collected. The report shall include a full discussion of the design and implementation of the pump test and shall describe and evaluate the resulting hydrogeologic data. The principal aquifer characteristics, including hydraulic conductivity, transmissivity, and storativity shall be calculated and presented. The limitations of the data and analyses shall also be addressed. The report and raw data from the test shall be incorporated into the Follow-On Report. The AE shall utilize the results of the pump test into the preparation of the Section C.

3.1.2.7 (Task 8) Geologic Cross-Sections. The AE shall use the information learned from the RI/FS Report, record search and drill logs prepared under this contract to construct at least six geologic cross-sections of the the Installation. The cross sections shall be a scale of approximately 1 inch = 100 feet and shall compliment previous sections produced in the RI/FS Report. These shall be submitted with the Remedial Investigation Follow-On Report.

3.1.2.8 (Task 9) Location Survey and Mapping. Each new stratigraphic test boring, monitoring well, pump test well, and the corner of the geophysical survey area shall be located and mapped according to the requirements of Section 8.0 of this Statement of Work. These requirements include all optional services which are exercised by the Contracting Officer.

3.1.2.9 Chemical Sampling and Analysis. The AE shall perform the following sampling and analyses in accordance with Section 6 of this Statement of Work. The results of the AE's sampling and analysis program hall be be included in the RI/FS Follow-On Report. The concentration of any contaminants encountered shall be compared with appropriate State and Federal regulations and guidelines. The total number of samples to be collected and analyzed by the AE are shown in Table 1. The AE will prepare cost estimates assuming that all analyses will be performed for each sample. During contract negotiations the AE and Contracting Officer will agree on a unit price for each method. If all analysis are not required on each sample the price will be reduced according to the agreed unit Price. If directed to do so by the Contracting Officer, the AE shall collect and send representative "split" samples to a contract Laboratory of the USEPA's choosing. The AE will not be responsible for the analysis of the "split" samples or subsequent reporting results. The AE, however, is required to defend his results if there is disagreement between the samples analyzed by the AE and the samples analyzed by the EPA contract laboratory. All wells should be sampled within a twenty-four hour time frame.

3.1.2.9.1 (Task 10) Collection and Analysis of Groundwater Samples. The AE shall collect and chemically analyze one groundwater sample from each of the new groundwater monitoring wells installed under this phase of the contract and one sample each from six of the existing groundwater monitoring

wells located in Dunn Field. A total of 26 wells will be sampled under this Task. The total numbers of samples and analyses for the field investigation and QA/QC are summarized in Table 1.

3.1.2.9.2 (Task 11) Collection and Analysis of Surface Water Samples After Rain Storm After a significant rain storm, the AE shall collect ten surface water samples for chemical analysis. The samples are to determine if storm waters are contributing to the degradation of the Lakes and run-off waters leaving the installation. Samples shall be collected from Lake Danielson, the nearby pond, and other locations which the AE has identified as representative surface water run-off from the installation. The total number of surface water and QA/QC samples and analyses are summarized in Table 1.

3.1.2.9.3 (Task 12) Collection and Analysis of Soil and Sediment Samples. The AE shall collect 100 shallow soil and sediment samples from various locations around the Installation to characterize the source and extent of contaminant reaching Lake Danielson and the Golf Course Pond and further define contaminated areas previously identified in the RI/FS. Shallow soil samples shall not exceed eighteen inches in depth. The AE shall also collect 20 soil samples from the five soil borings and 60 soil samples from the 20 monitoring well borings. The AE shall identify potentially contaminated zones during drilling operations, and collect soil samples for chemical analysis from monitoring well borings and soil borings in accordance with Section 6 of this Statement of Work. Drilling equipment and techniques shall be sufficient to obtain representative samples from contaminated zones for chemical analysis. The AE shall propose and justify sample locations in the stratigraphic Boring and Monitoring Well Installation Plan. The total number of soil and QA/QC samples and analysis are summarized in Table 1.

3.1.3 Treatment and Disposal of Drill Cuttings and Production Water.

3.1.3.1 (Task 13) Determine Drill Cuttings Collection and Disposal Requirements. Drill cuttings shall be collected in DOT approved containers provided by the AE. The containers shall be labeled and staged at a location on the facility identified by DDMT. The AE shall determine appropriate soil disposal requirement based on the results of chemical analyses. The AE shall also review the chemical analysis for the drill cuttings from the previous RI/FS Investigation and recommend and appropriate method of disposal. If the

cuttings generated under this contract are determined to be nonhazardous, they shall be disposed of on site, at no additional cost to the Government.

3.1.3.2 (Task 14) Determine Production Water Disposal Requirements. The AE shall collect and containerize well development water and production water resulting from the pump test and recommend to the Contracting Officer the most feasible way of disposing of the water. The AE shall determine water disposal requirements based on results of chemical analysis of the containerized water. "Clean" water shall be disposed of on the Installation, at no additional cost to the Government.

3.1.4 (Task 15) Analytical Data and Disposal Requirements Report. After completion of the chemical analysis, the AE shall transmit the results of the field and analytical data, in the form of a brief letter report, to CEHND-PM for Government review. This information shall be submitted before completion of the RI/FS Follow-On Report. The AE shall include a brief discussion on the disposal requirements determined in the previous tasks. The analytical data shall be submitted in accordance with Paragraph 4.

3.1.5 (Task 16) RI/FS Follow-On Report. At the completion of the preceding tasks, the AE shall use the information gathered to prepare a Follow on Report, which shall fully document all work performed at the Facility. This Report shall be written to Compliment the previous Remedial Investigation Report and fill in the data gaps needed to implement the designs for remedial actions. The Report shall be submitted according to the schedule in Section 4 of this SOW.

3.2 Technical Specifications For Interim Remedial Measures.

3.2.1 (Task 17)- Determine Groundwater Cleanup Levels. Based on close consultation with the Contracting Officer, State and Federal Regulators, the AE shall recommend and justify the interim levels to which the groundwater shall be treated,using the interim treatment facility. It is the Government's intention to meet as closely as possible, the final clean-up standard if this can be determined.

3.2.2 (Task 18)- Evaluate Treated Groundwater Disposal Options. After contaminated water is treated by the facility it must be disposed of. The AE shall determine the most economical, regulatorily acceptable method of

accomplishing the disposal of the treated water. As a minimum, the disposal options evaluated for treated water shall include: 1)re-injection, 2)discharge into surface drainages, 3)trucking and disposal off-site.

3.2.3 (Task 19)- Determine Air Emissions Requirements. The AE shall develop, justify and recommend applicable air emission requirements for the proposed facility. The proposed emission standards shall be technically feasible and economical, and shall meet regulatory requirements.

3.2.4 (Task 20)- Evaluate Hydrogeologic Impacts. The AE shall propose specific locations for extraction (and if applicable, injection) wells and associated pumping rates and determine the hydrogeologic impact resulting from withdrawal of groundwater. The AE shall be specific in identifying any potentially adverse impact on the environment that may result from withdrawal or reinjection of groundwater. The AE shall also determine and evaluate any adverse impacts associated with the disposal of the treated groundwater.

3.2.5 (Task 21)-Determine Permit Requirements. The AE shall determine which specific permits are required to construct and operate the proposed facility. Copies of the required permit forms shall be included as an appendix in the Report. Discussion of the time required for permit application and approval, and the fees applicable for each permit shall be included in the report.

3.2.6 (Task 22)-Recommend Treatment Alternative. The AE shall identify the most feasible alternative for treatment of the contaminated groundwater. As a minimum the AE shall review the RI/FS Report and various off-the-shelf technologies. The alternatives evaluated shall be based on economics, technical feasibility, regulatory requirements, environmental impacts, and required operating period. The AE's recommended implementation of the interim treatment system shall be based on site adaptation or designing a new facility, based on the use of readily available "off-the-shelf" technology as much as possible. The AE shall also discuss the optimum locations for the placement of equipment for the alternative chosen.

3.2.7 (Task 23)- Prepare Cost Estimate for Alternatives Evaluated. The AE shall provide a cost estimate for each of the alternatives evaluated. The cost estimate shall include estimates of the various capital costs and annual operation and maintenance costs for the recommended design life of the

facility. Also, the AE shall provide a unit price cost estimate for a convenient unit of treatment (such as cost per 1000 gallons) for each of the alternatives. This cost estimate shall be submitted as a part of the Report.

3.2.8 (Task 24)- Prepare Engineering Report. The AE shall prepare and submit to the Contracting Officer an Engineering Report which addresses the above identified items as well as other critical items, as identified. The report shall be submitted in accordance with the schedule presented in Paragraph 4.4.

3.2.9 (Task 25)- Prepare Environmental Assessment. The AE shall prepare an brief environmental assessment documentation for the (DDMT) Commander's signature, addressing the decision to implement the interim groundwater treatment facility at DDMT. As part of the documentation, the AE shall provide a discussion of environmental impacts for the interim groundwater treatment facility. Community concerns shall be documented and addressed. The Environmental Assessment shall be prepared in accordance with the National Environmental Policy Act (NEPA) as identified in 40CFR 1500-1508 and AR 200-2, and applicable State of Tennessee regulations. This Environmental Assessment shall be a separate deliverable under the schedule in Section 4.4 of this SOW.

3.2.10 (Task 26)- Prepare Section C-Work Statement/ Technical Requirements for the Interim Remedial Measure. Based on the results of the preceding tasks, the AE shall prepare a "Section C-Work Statement/Technical Requirements" for the selected Interim Remedial Measure (IRM), to treat contaminated groundwater at Defense Depot, Memphis. The system shall be physically located on the Installation. The system must meet the requirements of the State of Tennessee and all applicable regulations addressed in the preceding tasks. The AE shall make provisions for optional performance periods according to site requirements. The treatment system must be designed in a modular manner so that it can be easily transported within the Facility and be removed, once recovery activities are completed. Work performed under this task shall be submitted as a separate chapter of the Engineering Report. The Section C documents shall provide details of each of the following requirements as a minimum:

a. Design Parameters/Location Selection

b. Monitoring Well Installation Plan (Attachment A)

c. Health and Safety Plan (Attachment B, ER 385-1-92)

d. Institutional Requirements including, permits and cleanup levels and applicable State, Federal and local regulations.

e. Withdrawal System Requirements and equipment

f. Recovery System Requirements and Equipment

g. Complete System Site Specific Engineering and Construction Requirements

h. Startup of System

i. Prove-out of System

j. System Monitoring (air, water, etc.)

k. Operational and Maintenance Requirements

l. Performance Period (basic and optional periods)

m. Supporting Requirements (roads, foundation pads, utilities)

n. Quality Assurance and Quality Control (QA/QC) requirements and periodic performance for sampling and analysis. The QA/QC shall be in conformance with ER 1110-1-263, Chemical Data Quality Management for Hazardous Waste Remedial Activities.

3.2.10.1 As part of this effort, the AE shall also prepare DD Form 1664, Data Item Description, and DD Form 1423, Contract Data Requirements List, which provide a brief description and schedule for submittals required in the Service Contract. Copies of these forms will be provided by the Government.

3.2.11 (Task 27)- Cost Estimate for the Selected IRM. The AE shall provide a detailed cost estimate for the selected alternative. The cost estimate shall incorporate previous work performed in the alternatives evaluation. It shall be prepared according to the details and format of the Huntsville Design Manual for Architect Engineers (HNDM 1110-1-1) for each of the requirements identified in the previous task. The estimate shall document the appropriate backup and assumptions and be completely defensible. The AE shall provide a completed Standard Form 36 (to be provided by the Government). All cost estimate data provided under this task shall be separately bound , properly identified, and appropriately marked for security. It shall be submitted only to the Contracting Officer, Huntsville Division.

3.2.12 (Task 28)-Presentations and Meeting. After submittal of the draft Engineering Report, the AE shall present the results of the work performed at a meeting to be held at DDMT. The AE shall assume that two people from the AE firm will attend the meeting, which will last no longer than one day. The presentations shall consist of a summary of the work accomplished and anticipated, followed by open discussion among those present. It is expected that the meeting will be conducted in two sessions. The morning session will be held for US Government personnel. The afternoon session is planned as a briefing for the State Regulators.

3.3 OPTIONAL TASKS

3.3.1 The Proposed Plan and Record of Decision. If Directed by the Contracting Officer, The AE shall prepare the administrative documents for the Proposed Plan and Record of Decision (ROD). The documents shall be prepared according to "EPA Guidance on Preparing Superfund Decision Documents: The Proposed Plan and Record Of Decision". Both the Plan and ROD shall be submitted according to schedule in Section 4.

3.3.1.1 (Task 29, Option 1) -Prepare the Proposed Plan. The AE shall prepare a document which highlights the RI/FS and Follow-On Reports, and provides a brief analysis of the remedial alternatives under consideration for the sites. The Proposed Plan shall clearly identify the preferred alternative but shall also clearly state that a final remedial action has not yet been selected. This document will be submitted to the regulators and made available to the public for review and comment. It shall provide information on how the Public can participate in the remedial selection process and outline the processes involved in selecting the remedial action. It shall be written in a language that can be understood by the general public, avoiding technical jargon as much as possible. The Plan shall not be a duplication of the RI/FS Report and shall not exceed about 25 pages. As a part of this task, The AE shall also prepare for newspaper publication, a notification statement on the availability of the Proposed Plan for public review.

3.3.1.2 (Task 30, Option 2)- Record Of Decision. If directed by the Contracting Officer, The AE shall prepare a Record of Decision Document for

the DDMT Commander's signature. The ROD will identify the selected remedial action chosen for the site. It shall provide an overview of the problems at the site, an analysis of the alternatives, the rationale for selection and how the selected alternative meet statutory requirements. The Responsive summary of the ROD shall provide information about community preferences relating to the site and the remedial alternatives. It shall also clarify how public and regulatory comments were incorporated into the decision making process. The ROD will be submitted by the Government to the regulators for concurrence.

3.3.2 Optional Field Investigations and Geochemical Analyses. If directed to do so by the Contracting Officer, the AE shall perform one or any combination of these optional tasks to supply additional information that will be used to fully characterize the nature and extent of contaminant at the site. The work shall be performed according to the work plans and meet the requirements of Sections 6 and 7 of this Statement of Work. The AE shall make the appropriate changes in the Remedial Investigation Follow-On Report to reflect the results of any optional field work performed.

3.3.2.1 (Task 31, Option 3) Installation and Evaluation of Deep Groundwater Monitoring Wells. If directed by the Contracting Officer, the AE shall install two deep groundwater monitoring wells at locations recommended by the AE and approved by the Contracting Officer. A maximum of four hundred and forty (440) linear feet of drilling is provided for under this Task. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data and incorporate it into Remedial Investigation Follow-On Report. The numbers of samples and analyses are summarized in Table 3.

3.3.2.2 (Task 32, Option 4) Installation and Evaluation of Deep Groundwater Monitoring Wells. If directed by the Contracting Officer, the AE shall install 3 deep groundwater monitoring wells at locations recommended by the AE and approved by the Contracting Officer. A maximum of six hundred and sixty (660) linear feet of drilling is provided for under this Task. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data and incorporate it into the Remedial Investigation Follow-On Report. The numbers of samples and analyses are shown in Table 4.

3.3.2.3 (Task 33, Option 5) Installation and Evaluation of Additional Shallow Groundwater Monitoring Wells. If directed by the Contracting Officer, the AE shall install 3 additional shallow groundwater monitoring wells at locations recommended by the AE and approved by the Contracting Officer. A total of two hundred and forty (240) linear feet of drilling is provided for under this Task. The AE shall perform all associated work, including sampling and analysis, required to evaluate the data and incorporate it into the Remedial Investigation Follow-On Report. Specific samples and analyses are shown in Table 5.

3.3.2.4 (Task 34, Option 6) Installation and Evaluation of Additional Shallow Groundwater Monitoring Wells. If directed by the Contracting Officer, the AE shall install 7 additional shallow groundwater monitoring wells at locations recommended by the AE and approved by the Contracting Officer. A total of five hundred and sixty (560) linear feet of drilling is provided for under this Task. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data obtained and incorporate it into the Remedial Investigation Follow-On Report. The numbers of samples and analyses are shown in Table 6.

3.3.2.5 (Task 35, Option 7) Installation and Evaluation of Additional Shallow Groundwater Monitoring Wells. If directed by the Contracting Officer, the AE shall install 10 additional shallow groundwater monitoring wells at locations recommended by the AE and approved by the Contracting Officer. A total of nine hundred (900) linear feet of drilling is provided for under this Task. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data obtained and incorporate it into the Remedial Investigation Follow-On Report. The numbers of samples and analyses are shown in Table 7.

3.3.2.6 (Task 36, Option 8) Additional Round of Groundwater Sampling and analysis. The AE shall, if directed by the Contracting Officer, sample, analyze one additional round of groundwater samples consisting of 26 field samples and 6 additional samples for QA/QC. The AE shall perform all associated work required to evaluate the data and incorporate it into Remedial Investigation Follow-On Report. Table 8 identifies the required methods and number of samples and analytes that are to be analyzed.

3.3.2.7 (Task 37, Option 9) Installation and Evaluation of Additional Shallow Groundwater Monitoring Wells. If directed by the Contracting Officer, the AE shall install 3 additional shallow groundwater monitoring wells at locations recommended by the AE and approved by the Contracting Officer. A total of two hundred and seventy (270) linear feet of drilling is provided for under this Task. The AE shall perform all associated work, including sampling and analysis, required to evaluate the data and incorporate it into the Remedial Investigation Follow-On Report. Specific samples and analyses are shown in Table 9.

3.3.2.8 (Task 38, Option 10) Installation and Evaluation of Additional Shallow Groundwater Monitoring Wells. If directed by the Contracting Officer, the AE shall install 7 additional shallow groundwater monitoring wells at locations recommended by the AE and approved by the Contracting Officer. A total of six hundred hundred and thirty (630) linear feet of drilling is provided for under this Task. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data obtained and incorporate it into the Remedial Investigation Follow-On Report. The numbers of samples and analyses are shown in Table 10.

3.3.2.9 (Task 39, Option 11) Collection and Analysis of Additional Surface Water Samples. If directed by the Contracting Officer, the AE shall collect 6 additional surface water samples at locations recommended by the AE and approved by the Contracting Officer. The AE shall perform all associated work required to evaluate the data and incorporate it into the Remedial Investigation Follow-On Report. The numbers of samples and analyses are shown in Table 11.

3.3.2.10 (Task 40, Option 12) Additional Shallow Soil Sediment Sampling and Analysis. The AE shall, if directed by the Contracting Officer, collect 50 additional shallow soil samples at locations which have been determined by the AE and agreed on by the Contracting Officer. The samples shall be collected at a maximum depth of 18 inches below the soil or sediment surface. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data and incorporate it into Remedial Investigation Follow-On Report .The numbers of samples and analysis are shown in Table 12.

3.3.2.11 (Task 41, Option 13) Additional Shallow Soil Sediment Sampling and Analysis. The AE shall, if directed by the Contracting Officer, collect 50 additional shallow soil samples at locations which have been determined by the AE and agreed on by the Contracting Officer. The samples shall be collected at a maximum depth of 18 inches below the soil or sediment surface. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data and incorporate it into the Remedial Investigation Follow-On Report. The numbers of samples and analysis are shown in Table 13.

3.3.2.12 (Task 42, Option 14) Sampling and Analysis of Additional Soil Borings. The AE shall, if directed by the Contracting Officer, install three additional soil borings at locations which have been recommended by the AE and agreed on by the Contracting Officer. Four soil samples shall be collected from each boring. The maximum linear footage of drilling provided for under this task is six hundred and sixty (660) feet. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data obtained and incorporate it into the Remedial Investigation Follow-On Report. The numbers of samples and analysis are shown in Table 14.

3.3.2.13 (Task 43, Option 15) Sampling and Analysis of Additional Soil Borings. The AE shall, if directed by the Contracting Officer, install three additional soil borings at locations which have been recommended by the AE and agreed on by the Contracting Officer. Four soil samples shall be collected from each boring. The maximum linear footage of drilling provided for under this task is two hundred and forty (240) feet. The AE shall perform all associated work (including sampling and analysis) required to evaluate the data obtained and incorporate it into the Remedial Investigation Follow-On Report . The numbers of samples and analysis are shown in Table 15.

3.3.3 Task 44, Option 16) Community Support Meeting. If directed by the Contracting Officer, The AE shall provide support at three meetings be held at DDMT. The meetings may be needed to present and clarify technical aspects of the AE's work to the community and regulators. For negotiation purposes, the AE shall assume that two people from the AE's firm will attend each meeting, which will last no longer than one day.

TABLE 1
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER: (Task 10)							
Volatiles	26	2	2	2	2	1	1
B/N/A	26	2	2	2	2	NR	NR
Pesticides/PCBs	26	2	2	2	2	NR	NR
TRPH	0	--	--	--	--	NR	NR
Metals	26	2	2	2	2	NR	NR
Other: Mercury	26	2	2	2	2	0	0
SURFACE WATER: (Task 11)							
Volatiles	10	1	1	1	1	1	1
B/N/A	10	1	1	1	1	NR	NR
Pesticides/PCBs	10	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	10	1	1	1	1	NR	NR
Other: Mercury	10	1	1	1	1	0	0
SURFACE SOILS AND SEDIMENT: (Task 12)							
Volatiles	100	5	5	NR	NR	NR	NR
B/N/A	100	5	5	NR	NR	NR	NR
Pesticides/PCBs	100	5	5	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	100	5	5	NR	NR	NR	NR
Other: Mercury	100	5	5	NR	NR	NR	NR
SUBSURFACE SOILS: (Task 12)							
Volatiles	80	4	4	NR	NR	NR	NR
B/N/A	80	4	4	NR	NR	NR	NR
Pesticides/PCBs	80	4	4	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	80	4	4	NR	NR	NR	NR
Other: Mercury	80	4	4	NR	NR	NR	NR

TABLE 3
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER: (Option 3)							
Volatiles	2	1	1	1	1	1	1
B/N/A	2	1	1	1	1	NR	NR
Pesticides/PCBs	2	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	2	1	1	1	1	NR	NR
Other: Mercury	2	1	1	1	1	0	0
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	0	0	0	NR	NR	NR	NR
B/N/A	0	0	0	NR	NR	NR	NR
Pesticides/PCBs	0	0	0	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	0	0	0	NR	NR	NR	NR
Other: _____	0	0	0	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	6	1	1	NR	NR	NR	NR
B/N/A	6	1	1	NR	NR	NR	NR
Pesticides/PCBs	6	1	1	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	6	1	1	NR	NR	NR	NR
Other:_____	6	1	1	NR	NR	NR	NR

TABLE 4
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER: (Option 4)							
Volatiles	3	1	1	1	1	1	1
B/N/A	3	1	1	1	1	NR	NR
Pesticides/PCBs	3	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	3	1	1	1	1	NR	NR
Other: Mercury	3	1	1	1	1	0	0
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	9	1	1	NR	NR	NR	NR
B/N/A	9	1	1	NR	NR	NR	NR
Pesticides/PCBs	9	1	1	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	9	1	1	NR	NR	NR	NR
Other:_____	9	1	1	NR	NR	NR	NR

TABLE 5
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control: Splits/Dups QC(AE)	Splits/Dups QA(CE)	Rinsates QC(AE)	Rinsates QA(CE)	Trip Blanks QC(AE)	Trip Blanks QA(CE)
GROUNDWATER: (Option 5)							
Volatiles	3	1	1	1	1	1	1
B/N/A	3	1	1	1	1	NR	NR
Pesticides/PCBs	3	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	3	1	1	1	1	NR	NR
Other: Mercury	3	1	1	1	1	0	0
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	9	1	1	NR	NR	NR	NR
B/N/A	9	1	1	NR	NR	NR	NR
Pesticides/PCBs	9	1	1	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	9	1	1	NR	NR	NR	NR
Other:_____	9	1	1	NR	NR	NR	NR

TABLE 6
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER: (Option 6)							
Volatiles	7	1	1	1	1	1	1
B/N/A	7	1	1	1	1	NR	NR
Pesticides/PCBs	7	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	7	1	1	1	1	NR	NR
Other: Mercury	7	1	1	1	1	0	0
SURFACE WATER:							
Volatiles	0	0	0	0	0	0	0
B/N/A	0	0	0	0	0	NR	NR
Pesticides/PCBs	0	0	0	0	0	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	0	0	0	0	0	NR	NR
Other:_____	0	0	0	0	0	0	0
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	21	1	1	NR	NR	NR	NR
B/N/A	21	1	1	NR	NR	NR	NR
Pesticides/PCBs	21	1	1	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	21	1	1	NR	NR	NR	NR
Other:_____	21	1	1	NR	NR	NR	NR

TABLE 7
Types and Numbers of Samples Collected

		Quality Assurance and Quality Control					
	Field	Splits/Dups		Rinsates		Trip Blanks	
	Samples	QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER: (Option 7)							
Volatiles	10	1	1	1	1	1	1
B/N/A	10	1	1	1	1	NR	NR
Pesticides/PCBs	10	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	10	1	1	1	1	NR	NR
Other: Mercury	10	1	1	1	1	0	0
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	0	0	0	NR	NR	NR	NR
B/N/A	0	0	0	NR	NR	NR	NR
Pesticides/PCBs	0	0	0	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	0	0	0	NR	NR	NR	NR
Other: Mercury	0	0	0	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other:_____	--	--	--	NR	NR	NR	NR

TABLE 8
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control: Splits/Dups QC(AE)	Splits/Dups QA(CE)	Rinsates QC(AE)	Rinsates QA(CE)	Trip Blanks QC(AE)	Trip Blanks QA(CE)
GROUNDWATER: (Option 8)							
Volatiles	26	2	2	2	2	1	1
B/N/A	26	2	2	2	2	NR	NR
Pesticides/PCBs	26	2	2	2	2	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	26	2	2	2	2	NR	NR
Other: Mercury	26	2	2	2	2	0	0
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	0	0	0	NR	NR	NR	NR
B/N/A	0	0	0	NR	NR	NR	NR
Pesticides/PCBs	0	0	0	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	0	0	0	NR	NR	NR	NR
Other:_____	0	0	0	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other:_____	--	--	--	NR	NR	NR	NR

TABLE 9
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER: (Option 9)							
Volatiles	3	1	1	1	1	1	1
B/N/A	3	1	1	1	1	NR	NR
Pesticides/PCBs	3	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	3	1	1	1	1	NR	NR
Other: Mercury	3	1	1	1	1	0	0
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other:_____	--	--	--	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	0	0	0	NR	NR	NR	NR
B/N/A	0	0	0	NR	NR	NR	NR
Pesticides/PCBs	0	0	0	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	0	0	0	NR	NR	NR	NR
Other:_____	0	0	0	NR	NR	NR	NR

TABLE 10
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER: (Option 10)							
Volatiles	7	1	1	1	1	1	1
B/N/A	7	1	1	1	1	NR	NR
Pesticides/PCBs	7	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	7	1	1	1	1	NR	NR
Other: Mercury	7	1	1	1	1	0	0
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other:_____	--	--	--	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	0	0	0	NR	NR	NR	NR
B/N/A	0	0	0	NR	NR	NR	NR
Pesticides/PCBs	0	0	0	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	0	0	0	NR	NR	NR	NR
Other: Mercury	0	0	0	NR	NR	NR	NR

TABLE 11
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:	--	--	--	--	--	--	--
SURFACE WATER: (Option 11)							
Volatiles	6	1	1	1	1	1	1
B/N/A	6	1	1	1	1	NR	NR
Pesticides/PCBs	6	1	1	1	1	NR	NR
TRPH	0	0	0	0	0	NR	NR
Metals	6	1	1	1	1	NR	NR
Other: Mercury	6	1	1	1	1	0	0
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SUBSURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other:_____	--	--	--	NR	NR	NR	NR

TABLE 12
Types and Numbers of Samples Collected

		Quality Assurance and Quality Control					
	Field Samples	Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:	--	--	--	--	--	--	--
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SEDIMENT/SOIL (Option 12)							
Volatiles	50	3	3	NR	NR	NR	NR
B/N/A	50	3	3	NR	NR	NR	NR
Pesticides/PCBs	50	3	3	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	50	3	3	NR	NR	NR	NR
Other:_____	50	3	3	NR	NR	NR	NR

TABLE 13
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control: Splits/Dups QC(AE)	Splits/Dups QA(CE)	Rinsates QC(AE)	Rinsates QA(CE)	Trip Blanks QC(AE)	Trip Blanks QA(CE)
GROUNDWATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:	--	--	--	--	--	--	--
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SEDIMENT/SOIL (Option 13)							
Volatiles	50	3	3	NR	NR	NR	NR
B/N/A	50	3	3	NR	NR	NR	NR
Pesticides/PCBs	50	3	3	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	50	3	3	NR	NR	NR	NR
Other:_____	50	3	3	NR	NR	NR	NR

TABLE 14
Types and Numbers of Samples Collected

	Field Samples	Quality Assurance and Quality Control					
		Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:	--	--	--	--	--	--	--
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SEDIMENT/SOIL (Option 14)							
Volatiles	12	1	1	NR	NR	NR	NR
B/N/A	12	1	1	NR	NR	NR	NR
Pesticides/PCBs	12	1	1	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	12	1	1	NR	NR	NR	NR
Other:_____	12	1	1	NR	NR	NR	NR

TABLE 15
Types and Numbers of Samples Collected

		Quality Assurance and Quality Control					
	Field Samples	Splits/Dups		Rinsates		Trip Blanks	
		QC(AE)	QA(CE)	QC(AE)	QA(CE)	QC(AE)	QA(CE)
GROUNDWATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:	--	--	--	--	--	--	--
SURFACE WATER:							
Volatiles	--	--	--	--	--	--	--
B/N/A	--	--	--	--	--	NR	NR
Pesticides/PCBs	--	--	--	--	--	NR	NR
TRPH	--	--	--	--	--	NR	NR
Metals	--	--	--	--	--	NR	NR
Other:_____	--	--	--	--	--	--	--
SURFACE SOILS:							
Volatiles	--	--	--	NR	NR	NR	NR
B/N/A	--	--	--	NR	NR	NR	NR
Pesticides/PCBs	--	--	--	NR	NR	NR	NR
TRPH	--	--	--	NR	NR	NR	NR
Metals	--	--	--	NR	NR	NR	NR
Other: _____	--	--	--	NR	NR	NR	NR
SEDIMENT/SOIL (Option 15)							
Volatiles	12	1	1	NR	NR	NR	NR
B/N/A	12	1	1	NR	NR	NR	NR
Pesticides/PCBs	12	1	1	NR	NR	NR	NR
TRPH	0	0	0	NR	NR	NR	NR
Metals	12	1	1	NR	NR	NR	NR
Other:_____	12	1	1	NR	NR	NR	NR

4.0 SUBMITTALS AND PRESENTATIONS

4.1 Format and Content. The Engineering Reports presenting all data, analysis, and recommendations shall be prepared in a standard format for AE reports and in accordance with the Table of contents in Paragraph 4.2, where applicable. All drawings shall be of engineering quality in drafted form with sufficient detail to show interrelations of major features on the installation site map. When drawings are required, data may be combined to reduce the number of drawings. The report shall consist of 8-1/2" x 11" pages with drawings folded, if necessary, to this size. A decimal paragraphing system shall be used. The report covers shall consist of durable 3-ring binders and shall hold pages firmly while allowing easy removal, addition, or replacement of pages. A report title page shall identify the AE, the Corps of Engineers, Huntsville Division, and the date. The AE identification shall not dominate the title page. Each submittal page of the draft document shall be stamped "DRAFT". This Statement of Work shall be incorporated as an appendix in the draft report only. Submittals shall include incorporation of all previous review comments accepted by the AE as well as a section describing the disposition of each comment. Disposition of comments submitted with the final report shall be separate from the report document. All final submittals shall be sealed by the Certified Professional Geologist and the registered Professional Engineer-In-Charge.

4.2 Engineering Report Contents. The contents of the engineering reports shall be arranged in accordance with the following outlines, as applicable:

FOLLOW-ON REPORT

EXECUTIVE SUMMARY

1.0 INTRODUCTION

- 1.1 PURPOSE OF THE REPORT
- 1.2 SITE BACKGROUND
- 1.3 NATURE AND EXTENT OF PROBLEM(S)
- 1.3 PREVIOUS INVESTIGATIONS
- 1.4 REPORT ORGANIZATION

2.0 STUDY AREA INVESTIGATION

- 2.1 DEMOGRAPHY
- 2.2 LAND USE
- 2.3 NATURAL RESOURCES
- 2.4 CLIMATOLOGY

3.0 PHYSICAL CHARACTERISTICS

- 3.1 SOILS
- 3.2 GEOLOGY
- 3.3 GROUNDWATER
- 3,4 SURFACE WATER
- 3.5 SEDIMENTS
- 3.6 FLOOD POTENTIAL
- 3.7 DRAINAGE

4.0 NATURE AND EXTENT OF CONTAMINATION

- 4.1 WASTE TYPES
- 4.2 WASTE COMPONENT CHARACTERISTICS AND BEHAVIOR
- 4.3 SOURCES

5.0 CONTAMINANT FATE AND TRANSPORT

6.0 BASELINE RISK ASSESSMENT

- 6.1 PUBLIC HEALTH EVALUATION
- 6.1.1 EXPOSURE ASSESSMENT
- 6.1.2 TOXICITY ASSESSMENT
- 6.1.3 RISK CHARACTERIZATION
- 6.2 ENVIRONMENTAL ASSESSMENT

7.0 SUMMARY AND CONCLUSION

8.0 RECOMMENDATIONS FOR FUTURE WORK

9.0 RECOMMENDED REMEDIAL ACTION ALTERNATIVES

APPENDICES (if applicable)

NOTE: The complete outline for this report is found in Chapter 3 of OSWER Directive 9355.3-01. Additional guidance is found in the RFI Guidance Document Ref.10.8.

REPORT II.

OUTLINE FOR THE PROPOSED PLAN

1. STATEMENT OF DOCUMENT'S PURPOSE

2. SITE DESCRIPTION

3. SCOPE AND ROLE OF RESPONSE ACTION

4. ALTERNATIVES ANALYZED

5. PREFERRED ALTERNATIVE

6. ROLE OF COMMUNITY

Further guidance is available in OSWER DIRECTIVE 9355.3-02. Guidance in Preparing Superfund Guidance Documents: the Proposed Plan and Record of Decision.

4.3 Presentations. The AE shall make presentations of work performed according to the schedule in paragraph 4.7. The presentation will consist of a summary of the work accomplished and anticipated followed by an open discussion among those present.

4.4 Minutes of Meeting. Following the presentation, the AE shall prepare and submit minutes of the meeting within 10 days to the Contracting Officer and DLA.

4.5 Correspondence. The AE shall keep a record of each phone conversation and written correspondence affecting decisions relating to the performance of this contract. A summary of the phone conversations and written correspondence shall be submitted with the monthly progress report to the Contracting Officer.

4.6 Monthly Progress Report. The AE shall prepare and submit a monthly progress report 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 AE shall state what actions are anticipated in order to get back on schedule. The report shall be submitted not later than the 10th day of each calendar month and shall discuss previous calendar month's activities. The report shall be submitted to the Contracting Officer and DLA.

4.7 Completion Dates.

Deliverables shall be submitted according to the following schedule. Contract Award is expected to be on or before September 1991.

MID-SEPT CONTRACT AWARD

	Calendar Days After Contract Award		
	Draft	Draft Final	Final
F'ld Inv'st Plan	35	55	70
IRM- Pump Test plan	35	55	70
Analytical Data			130
Follow-On Report	160	200	230
Presentation Meeting N/A			185
Eng. Report	200	245	280
Section C — ADVERTISING AND INTERIM MEASURE IMPLEMENTATION	240	280	310
Presentation Meeting			260
The Proposed Plan	340	370	390
Presentation Meeting			360
The ROD	410	440	460

The overall completion date for this Contract shall be TBD.

Submittals. The AE shall furnish copies of the reports as well as all technical submittals to each addressee listed below in the quantities indicated. Submittals are due at each of the offices indicated below not later than the close of business on the dates shown in Paragraph 4.7. Following each submission, comments generated as a result of the Government's review shall be incorporated.

	DRAFT SUBMITTALS	FINAL SUBMITTALS
Commander U.S. Army Corps of Engineers ATTN: CEHND-ED-PM, David Hasley 106 WYNN DRIVE Huntsville, AL 35805	4	4 copies, plus reproducible and floppy disk in ASCI format of final submittal
Commander Defense Logistic Agency ATTN: DLA-WS/Depot Dennis Lillo Cameron Station Alexandria, VA 22304	2	2
Commander U.S. Army Environmental Hygiene Agency ATTN: HSHB-ME-SG Aberdeen Proving Ground, MD 21010-5422	2	2
Commander Defense Depot Memphis Tennessee ATTN: Danny Chumney Memphis, Tennessee	2	2

5.0 SAFETY REQUIREMENTS

The A-E shall prepare and submit a Site 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), the U. S. Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1). Some requirements of this section are not intended to dictate site operations and procedures for health and safety, but to specify what information pertaining to the A-E's health and safety program is required to be presented in the submittal. Where a specific element is not applicable, the A-E shall make negative declaration in the plan to establish that adequate consideration was given the topic, and a brief justification for its omission shall be given.

5.1 General. The SSHP shall be reviewed and approved 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), responsible to the A-E may 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 and health and safety responsibilities of each key person shall be discussed. The organizational structure, with lines of authority for safety and health and overall responsibilities of the A-E and all subcontractors shall be provided. 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 resume.

5.3 Site Description and Contamination Characterization. The A-E shall provide a description of the site, including a complete summary of contaminants (chemical/biological names, concentration ranges, media in which found, locations on-site and estimated quantities/volumes) and health hazards anticipated on site. This site description shall be based on results of previous studies, site history and prior site uses and activities.

5.4 Hazard Assessment and Risk Analysis. The A-E shall provide a complete description of the work to be performed with a complete summary of hazards anticipated. 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, and the applicable regulatory standards (PEL's) and/or recommended protective exposure levels (TLV's) 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 Y). All Accident Prevention Plan elements required by EM 385-1-1, Appendix Y, 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 SSHP and contract requirements.

5.6 Training. Training for all on-site personnel to include initial, site specific, supervisory, and refresher training shall be in accordance with 29 CFR 1910.120 Final Rule. All authorized visitors to the site shall be given a pre-entry site safety and health briefing. The content, duration, and frequency, of training shall be described. Material Safety Data Sheets (MSDS) for each hazardous substance 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. The A-E shall provide written certification that the required training has been received by the A-E'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) and 29 CFR 1910.134. Minimum levels of protection necessary for each task/operation to be performed based on the hazard assessment/risk analysis required in paragraph 5.4 shall be proposed. Include specific types and materials for protective clothing and respiratory protection. Establish and justify upgrade/downgrade criteria based upon the action levels established as required by paragraph 5.4.

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 and ANSI Z-88.2. 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 provided. A written medical opinion from the examining physician shall be made available to the CO upon request for any site employee.

5.9 Environmental and Personal Monitoring. The A-E shall specify for on-site and perimeter, where applicable, the types and frequency of monitoring/ sampling to be performed. When applicable, NIOSH and or EPA sampling and analytical methods shall be used. Personal samples, where necessary, shall be analyzed only by laboratories successfully participating 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. All monitoring and sampling protocol shall be discussed in detail. Include instrumentation to be used and calibration to be performed. All monitoring results shall be compared to action levels to determine the need for corrective actions. Meteorological, noise and radiation monitoring shall be conducted as needed depending upon the site hazard assessment. All environmental and personal monitoring protocol shall

be discussed in detail.

5.10 Site Control. The SSHP shall include a site map, description of work zone delineation, on/off site communication systems, site access controls, and security procedures.

5.11 Personnel and Equipment Decontamination. The A-E shall develop and specify decontamination procedures in accordance with 29 CFR 1910.120 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 shall be specified.

5.12 Emergency Response; Equipment and Procedures. An Emergency Response Plan as required by 29 CFR 1910.120 shall be prepared. Specify the emergency equipment and the location of such equipment to be present on site. Provide telephone numbers and points of contact for emergency services and the appropriate Governmental Representatives. A map showing the route to the hospital that has been contacted and informed of the type of work and potential hazards on the site shall be provided. At least one person trained and certified in first aid/CPR is to be on site at all times during site operations. The first aid/ CPR attendant(s) shall be identified and credential provided.

5.13 Standard Operating Procedures, Engineering Controls and Work Practices. The A-E shall develop Standing Operating Procedures for minimizing hazards and taking 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.

5.14 Logs, Reports and Recordkeeping. Recordkeeping 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 described. All personnel exposure and medical monitoring records shall be maintained in accordance with applicable

OSHA standards, CFR 1904, 1910 and 1926. 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.

6.0 CHEMICAL DATA AND LABORATORY REQUIREMENTS

6.1 Chemical Data Acquisition Plan (CDAP). The plan 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 as well as laboratory procedures. The plan shall clearly describe how the A-E shall ensure that sample integrity and chain of custody of all samples is not compromised prior to delivery to the laboratory. The plan shall be a brief and concise description of the field and lab work required. Results of the field and laboratory controls shall be evaluated and placed in the draft and final Engineering Reports. The A-E shall provide the laboratory QA/QC plan as an appendix to the CDAP. The plan shall address each requirement as identified in ER 1110-1-263 (Reference 11.21 and shall be written in the format as shown in Appendix C, paragraph C.5 of that same document.

6.2 Laboratory Qualifications. The analytical laboratory utilized by the A-E must be validated by the Corps of Engineers' Missouri River Division (CEMRD) and any applicable State of Philadelphia approvals to perform the analytical methods required by this SOW.

6.3 Quality Assurance Laboratory Requirements. The A-E must provide coordination and quality assurance samples (collected and transported by the A-E) to the Government Quality Assurance (QA) lab. The QA samples shall be splits of the required field control samples shown in Tables 3-6 and 3.7. Each field control sample collected shall be divided equally, one portion sent to the QA laboratory and the remainder sent to the A-E's lab. QA samples include all sample matrices and analysis parameters. The A-E shall provide the MRD Lab a two week notice of sample shipment.

6.4 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. These shall be reported in accordance with reference 11.22. These data shall be included in the analytical submittal as well as the draft and final engineering reports. The A-E laboratory must hold and make available all project raw data for a period of two years after samples have been analyzed.

7.0 SOIL BORING, PUMP TEST WELLS AND MONITORING WELL DESIGN AND INSTALLATION REQUIREMENTS

The following requirements shall be incorporated into the AE's Soil Boring and Well Installation Plan and followed in the field. The plan shall be prepared using the following outline as applicable:

SECTION 1.0 INTRODUCTION AND BACKGROUND
SECTION 2.0 SOIL BORING LOCATIONS AND DEPTHS
SECTION 3.0 WELL LOCATIONS AND DEPTHS
SECTION 4.0 DRILLING EQUIPMENT
SECTION 5.0 DRILLING PROCEDURES
SECTION 6.0 CONTAMINATION PREVENTION AND DECONTAMINATION PROCEDURES
SECTION 7.0 WELL DESIGN AND INSTALLATION
SECTION 8.0 WELL DEVELOPMENT
SECTION 9.0 IN-SITU PERMEABILITY
SECTION 10.0 PROJECT ASSIGNMENTS & PERSONNEL QUALIFICATIONS

7.1 Location. Soil boring and monitoring well locations shall be proposed by the AE as part of the plan prior to commencement of drilling activities. The AE shall obtain written approval from the Facility Engineer, DDMT to drill at each site to avoid disturbing buried utilities.

7.2 Design of Monitoring Wells. Recommended practices for the construction of the monitoring wells are set forth in " Handbook of suggested practices for the Design and Installation of Groundwater Monitoring Wells" and EPA Technical Enforcement Guidance Document. Additional design recommendations are given in "Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities," USEPA Publ. No. EPA 530/SW-611 (Reference 10.18). State or local certification requirements shall be met. The AE shall

be responsible for obtaining any soil boring or well drilling permits required by state or local authorities and for complying with state or local regulations concerning submission of well logs and samples.

7.3 Installation of Monitoring Wells.

7.3.1 General Requirements. The AE shall provide all drilling equipment, materials and personnel required to install the wells, as well as a qualified geologist or geotechnical engineer who shall be on-site for all drilling, installation, development and testing operations. The AE shall use dry, hollow stem or solid auger, or air-rotary methods, depending on the purpose of the well. The AE shall proposed the appropriate drilling methods in the Soil Boring and Monitoring Well Installation Plan. Air- rotary methods shall not be used to drill wells/borings from which samples will be collected for chemical analysis. Any changes to the approved drilling methods must be submitted to the Contracting Officer for prior approval.

7.3.2 Protection of Water Yielding Zones. The use of any liquid, including water, is to be generally avoided during drilling and will only be permitted by the Contracting Officer in cases where it is determined, by the Government, to be absolutely necessary for successful installation of the well. If water is required during drilling or well installation, only potable water will be permitted. Any proposed use and source of water must be approved by the Contracting Officer beforehand. Grease or oil on drill rod joints will not be permitted. Dispersing agents (such as phosphates) or acids shall not be used. There shall be no attempt made to chemically disinfect the well. The rigs, drill tools, and associated equipment shall be cleaned with steam and washed and rinsed with a decontaminating liquid prior to commencement of drilling at each well and boring location. It is expressly required that toxic and/or contaminating substances shall not be used during any part of the drilling, well installation or well development processes. All drilling activities and methods shall be sufficient to positively prohibit the introduction of contaminants from one water bearing stratum to another via the well bore.

7.3.3 Well Design

7.3.3.1 Boring Diameter. The boring shall be of sufficient diameter to permit at least two (2) inches of annular space between the boring wall and

all sides of the centered riser and screen

7.3.3.2 Well Riser and Screen.

7.3.3.2.1 Riser. Monitoring well risers shall consist of new threaded flush joint polyvinyl Chloride (PVC) pipe. For the deep wells, riser shall be of schedule 80 (PVC) of nominal (4) inches diameter. Risers for the the shallow wells shall of nominal 2 inch schedule 40 PVC pipe. For the pump test wells, risers shall consist of new threaded flush joint schedule 80 polyvinyl chloride (PVC) pipe with a nominal 8 inch diameter. The Risers as a minimum, shall conform to the requirements of ASTM-D 2241 for PVC pipe and shall bear marking that will identify the material as that which is specified.

7.3.3.2.2 Screen. The monitoring well screen shall be a minimum of ten feet in length and shall be constructed of PVC material similar to the well riser. Pump test well screen length shall be determined by the AE. The screen shall be noncontaminating, factory constructed and of "continuous wrap" or "mill-slot" design. Field slotted or cut screen is not permitted. The slot size shall be determined by the AE and designed to be compatible with aquifer and gravel pack material. The AE shall provide a sieve analysis of one or more representative samples of the aquifer material in which the screen is placed and which demonstrates that the screen is compatible with the aquifer material. The sieve analysis shall be conducted in accordance with ASTM C 117 and C 136 and results shall be submitted to the CO with the field boring logs.

7.3.3.2.3 Screen Location. The AE shall have the responsibility of placing the well screen in the appropriate location in the bore hole to accommodate fluctuation in the water table, so that the completed monitoring well functions satisfactorily.

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

7.3.3.2.5 Well Plumbness and Alignment. All risers and screens shall be set round, plumb, and true to line. Centralizers shall be used to assure

plumbness and alignment of the wells. Centralizers shall not be installed on the well screen.

7.3.3.3 Gravel Pack. The AE shall select and use clean, inert, non-carbonate materials to construct a uniform and continuous gravel pack designed to prevent migration of fines into the screen. The gravel pack shall be placed by tremie pipe from the bottom of the boring to at least two (2) feet above the top of the well screen.

7.3.3.4 Bentonite Seal and Grout. A minimum two (2) foot seal, consisting of tamped bentonite pellets or bentonite slurry shall be placed into the annular space between the riser and boring wall at the top of the gravel pack in monitoring wells. Pump test well annular seal shall be a minimum of five (5) feet in length. Non-shrinking cement grout shall then be placed from the top of the bentonite seal to the ground surface. The cement grout shall consist of a mixture of portland cement (ASTM-C 150), and water in the proportion of not more than seven (7) gallons of clean water per bag of cement (One cubic foot or 94 pounds). Additionally, 3 percent by weight of bentonite powder shall be added if permitted by State regulations.

7.3.4 Soil Sampling for Geotechnical Analysis. During drilling of soil borings and monitoring wells, soil samples shall be collected and geotechnical analysis shall be performed as outlined below.

7.3.4.1 Dry, hollow stem or solid auger methods of drilling shall be used for the "shallow" borings and wells.

7.3.4.2 Soil samples shall be taken continuously for the first 10 feet and at 5-foot intervals thereafter.

7.3.4.3 Sampling shall be done with a split-spoon sampler (ASTM- D 1586-67) or thin wall sampler (ASTM-D 1587-74) using standard sampling techniques in the auger borings.

7.3.4.4 Samples shall be stored in labeled, air-tight plastic or glass containers by the AE until such time as they are needed for testing or the contract is complete.

7.3.4.5 All soil samples shall be visually classified by the Unified Soil Classification System. The AE shall verify the classification by laboratory analyses consisting of the following:

Test Description	# Required/ Well
a. Grain-size distribution (ASTM-D 421 & 422)	2
b. Atterberg limits (ASTM-D 4318)	2
c. Moisture content (ASTM-D 2216)	2

Specific soil samples to be tested, along with type of test, will be determined by the AE after reviewing the boring logs. Laboratory analyses shall use equipment and methods described in EM-1110-2-1906 (Ref. 10.4), or ASTM manuals (Referenced above).

7.3.5 Rock Sampling. Rock samples will be logged continuously. Samples will be stored in wooden core boxes until the project is complete. Core sizes shall be a minimum of 2 inches in diameter. The core shall be photographed with 35mm color slides and shall be submitted as part of the Final Report.

7.3.6 Protection of Well. At all times during the progress of the work, precautions shall be used to prevent tampering with the well or the entrance of foreign material into it. Upon completion of the well, a suitable vented cap shall be installed to prevent material from entering the well. The well riser shall be surrounded by a larger diameter steel casing set into a concrete pad and rising 24" to 36" above ground level. The steel casing shall be provided with lock and cap. A minimum three foot square, four inch thick concrete pad, sloped away from the well shall be constructed around the well casing at the final ground level elevation. In accordance with Paragraph 8.2, a survey marker shall be permanently placed in each pad. Three, two-inch or larger diameter steel posts shall be equally spaced around the well and embedded in the concrete pad. The ground immediately surrounding the top of the well shall be sloped away from the well. There shall be no openings in the protective casing wall below its top.

7.3.7 Temporary Capping. Any well that is to be temporarily removed from service, or left incomplete due to delay in construction, shall be capped with a watertight cap and equipped with a "vandal proof" cover satisfying applicable state or local regulations or recommendations.

7.3.8 Field Logs. The field geologist or geotechnical engineer shall

maintain suitable logs detailing drilling and well construction practices. Logs shall be submitted for both wells and the soil borings. One copy of each field log including the required color slides, shall be submitted to the Contracting Officer not later than 10 calendar days after each well is completed. The well will not be accepted by the Contracting Officer until the logs are received and approved. Information provided in the logs shall include but not be limited to the following:

7.3.8.1 Reference elevation for all depth measurements.

7.3.8.2 Depth of each change of stratum.

7.3.8.3 Thickness of each stratum.

7.3.8.4 Identification of the material of which each stratum is composed according to the Unified Soil Classification System, or standard rock nomenclature, as necessary.

7.3.8.5 Depth interval from which each formation sample was taken.

7.3.8.6 Depth at which hole diameter (bite sizes) change.

7.3.8.7 Depth at which groundwater is first encountered.

7.3.8.8 Depth to the static water level and changes in static water level with well depth.

7.3.8.9 Total depth of completed well.

7.3.8.10 Depth or location of any loss of drill water circulation, loss of tools or equipment.

7.3.8.11 Location of any fractures, joints, faults, cavities or weathered zones.

7.3.8.12 Depth of any grouting or sealing.

7.3.8.13 Nominal hole diameters.

7.3.8.14 Amount of cement used for grouting or sealing.

7.3.8.15 Depth and type of well casing.

7.3.8.16 Description (to include length, location, diameter, slot sizes, material, and manufacturer) of well screen(s).

7.3.8.17 Any sealing-off of water-bearing strata.

7.3.8.18 Static water level upon completion of the well and after development.

7.3.8.19 Drilling date or dates.

7.3.8.20 Construction details of monitoring well.

7.3.9 Final Logs. The field logs shall be edited and drafted for inclusion into the final report.

7.4 Well Development. After each well has been constructed, but no sooner than 48 hours after grouting is completed, the AE shall direct a program for the development of the well by pumping and/or surging, without the use of acids, dispersing agents or explosives. Development shall continue for a period of 4 hours (minimum), and until groundwater removed from the well is clear and free of sand and drilling fluids. No water or other liquid may be introduced into the well other than formation water from that well. After final development of the well, the AE shall collect approximately 1 liter of water from the well in a clear glass jar, label and photograph it with a 35mm color slide, and submit the slide as part of the well log. The photograph shall be a suitably back-lit close up which shows the clarity of the water.

7.5 In-Situ Permeabilities. After development of monitoring wells, the AE shall calculate for each, the in-situ permeabilities of the significant water bearing strata, using a professionally recognized and proven method. Apart from formation water, no water or other liquid may be introduced into the well.

7.6 AE Responsibility for Monitoring Wells.

7.6.1 It is the responsibility of the AE to properly plan, design, install, develop, and test monitoring wells so that they are suitable to produce groundwater samples representative in quantity and quality of subsurface conditions. The AE shall ensure that the requirements of this statement of work and best construction practices are carried out.

7.6.2 If the AE, due to his inadequate design or construction, installs monitoring wells that are not functional or not in accordance with specifications, the Contracting Officer will reject the well and direct the AE to repair or replace it at the Contacting Officer's discretion. This work shall be done at no additional cost to the Government.

7.6.3 If a monitoring well is rejected by the Contracting Officer, or is abandoned by the AE for any reason, the hole shall be backfilled with neat cement grout from top to bottom by the AE at no additional cost to the Government.

7.7 Method of Payment for footage Drilled For Monitoring Wells/Boring. The footage for wells/borings specified in each task represents the maximum drilling footage projected under the contract for each task. The footage specified under each task shall not be exceeded, except by the express direction of the Contracting Officer. It is possible that the well/boring installation objectives will be met before the maximum footage specified for each task is expended, in which case the aggregate depth of wells/borings drilled under the task will be less than the maximum footage specified. If this occurs, the AE will be paid only for the footage actually drilled. During contract negotiations, the Contracting Officer and AE will agree upon a unit price per foot for soil borings and monitoring wells. For all contractual footage not drilled under any individual well/boring task, a deduction from the contract price shall be made at the agreed-upon unit price rate.

7.8 Method of Payment for Footage Drilled For Monitoring Wells/Borings. The footage for wells/borings specified in each task represents the maximum drilling footage projected under the contract for each task. The contractually specified footage for each task shall not be exceeded for any reason, except by express direction of the Contracting Officer. ~~Unless such direction is received from the Contracting Officer, the AE will not be paid for any footage drilled beyond the amount specified in the SOW task.~~ However, It is possible that the well/boring installation objectives will be met before the maximum specified footage per individual task is expended, in which case the aggregate depth of wells/borings drilled under the task will be less than the specified maximum. If this occurs the AE will be paid only for the footage actually drilled. During contact negotiations the Contracting Officer and the AE will agree upon a unit price per foot for soil borings and monitoring wells. ~~credited to the Government for soil boring and for monitoring well footage not drilled.~~ For all contractually specified footage not drilled under any individual well/boring task, a deduction from the contract price shall be made at the agreed-upon unit price rate.

7.7.1 Credit to Contract for Soil Boring Footage Not Drilled. The Government shall be credited $TBD per linear foot of soil boring footage not drilled.

7.7.2 Credit to Contract for Shallow Monitoring Well Footage Not Drilled. The Government shall be credited $TBD per linear foot of shallow monitoring well footage not drilled.

7.7.3 Credit to Contract for Deep Monitoring Well Footage Not Drilled. The Government shall be credited $TBD per linear foot of deep monitoring well footage not drilled.

8.0. LOCATION SURVEYS AND MAPPING.

8.1 Control Monument. Three permanent control monuments with a 3.5 inch diameter domed brass, bronze, or aluminum alloy cap shall be set in accessible locations within or immediately adjacent to the limits of the project area. These monuments shall be set no closer than 500 feet to each other. Coordinates (1:10,000) and elevations (1:5,000) to Third Order accuracies or better shall be established to the closest 0.01 foot for each monument. The coordinates shall be referenced to the State Plane Grid System, and the elevations shall be referenced to the 1929 North American Vertical Datum. Each survey marker and monument shall be stamped with the following data by using steel dies that are a minimum of 1/8 inch tall.

8.1.1 USAED, Huntsville, AL.

8.1.2 Identification Number or Name.

8.1.3 Month and Year Established.

8.2 Location Surveys. A 3.5 inch diameter, domed survey marker, (cap) composed of brass, bronze or aluminum alloy shall be permanently set in the concrete pad surrounding each well. Coordinates and elevations shall be established for all the corners of the geophysical survey, each soil boring/samples, and each monitoring and pump test well. The coordinates shall be to the closest 1.0 foot and referenced to the State Plane Coordinate System. Elevations to the closest 0.01 foot shall be provided for the survey marker and the top of the casing at each well. These elevations shall be referenced to the National Geodetic Vertical Datum of 1929.

8.3 The location, identification, coordinates and elevations of the geophysical survey, borings/samples, wells and monuments shall be plotted map(s) at a scale of 1 inch = 300 feet or larger. A tabulated list of the corners of the geophysical survey, borings/samples, monitoring wells and

monuments including their coordinates and elevations, all field books, and all computation sheets shall be prepared and submitted to the Huntsville Division (CEHND), ATTN: CEHND-ED-CS. The tabulation shall consist of the designated name or number of the borings/samples, well or monument, the X and Y coordinates, and all the required elevations. These items shall be submitted to CEHND no later than the Draft Report Submission.

9.0 PUBLIC AFFAIRS

The AE shall not make available to the news media or otherwise publicly disclose any data generated or reviewed under this contract. The AE shall refer all requests for information to DDMT. Reports and data generated under this contract shall become the property of the Department of Defense and distribution to any other source by the AE, unless authorized by the Contracting Officer, is prohibited.

10. REFERENCE DOCUMENTS

10.1 "Engineering Guidance Design Manual for Architect-Engineers" HNDM-1110-1-1, US Army Engineer Div.,Huntsville. Aug. 1986

10.2 Code of Federal Regulations, Volume 40, latest ed.

10.3 "US Army Corps of Engineers. Safety and Health Requirements Manual Manual", EM-385-1-1. US Army Corps of Engineers. latest Ed.

10.4 OSHA. Construction Industry Standards. 29 CFR 1910

10.5 Hazardous Waste Site Operations and Emergency Responses. Federal Register. Vol. 54. NO.42. March 1989.

10.6 NIOSH/OSHA/USCG/EPA. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. October 1985

10.7 US Army Engineering Regulation. DRAFT. Safety and Occupational Health Document Requirements for Hazardous Waste Activities. ER 385-1-92.

10.8 Defense Depot Memphis, Tennessee. Remedial Investigation Final Report. Law Environmental Inc. Prepared for US Army Corps of Engineers,

Huntsville Division. 1990.

10.9 Defense Depot Memphis, Tennessee. Feasibility Study Final Report. Law Environmental Inc. Prepared for US Army Corps of Engineers, Huntsville Division. 1990.

10.10 RCRA Facility Investigation Guidance (RFI). OSWER Directive 9502.00-6D. EPA 530/SW-89-031. Office of Solid Waste. May 1989.

10.11 "Preparation of Statement of Work (SOW)," Military Handbook - 245B, 1 June 1983.

10.12 "Draft Guidance on Preparing Superfund Decision Documents: The Proposed Plan and Record of Decision", EPA, Oswer Directive 9355.3-02, March 1988.

10.13 Army Regulations, 200-2, "Environmental Quality , Environmental Effects of Army Actions", December 1988.

10.14

10.15 Chemical Data Quality Management for Hazardous Waste Remedial Activities. ER 1110-1-263

10.16 RCRA Groundwater Monitoring Technical Enforcement Guidance Document. USEPA. OSWER Directive. 9950.1 September 1986.

10.17 "Manual of Water Well Construction Practices," USEPA Publ. EPA 570/9-75-001

10.18 "Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities," USEPA Publ. No. EPA 530/SW-611.

10.19 US EPA Handbook. Community Relations in Superfund. 1986.

10.20 ER 1110-1-263. Chemical Data Quality Management for Hazardous Waste Water Remedial Activities. US Army Corps of Engineers. CE-MRD-ED-GL. August 1989.

10.21 Memorandum, Minimum Chemistry Data Recording Requirements for DERP and Superfund HTW Projects. US Army Corps of Engineers. CE-MRD-ED-GL. August 1989.

10.22 RFA Report. Department of Defense Memphis Depot Memphis, Tn.

Prepared for USEPA by A.T. Kearney, Inc. Jan. 1990.

10.23 Defense Depot, Memphis. USEPA RCRA Part B Permit. September 1990.

10.24 USEPA Region 4. Engineering Support Branch. Standard Operating Procedure and Quality Assurance Manual.

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE