Mr. Richard Mitzelfelt  
Chief, Ground Water/Hazardous Waste Bureau  
State of New Mexico  
1190 St. Francis Drive  
P.O. Box 968  
Santa Fe, New Mexico 87504-0968

Dear Mr. Mitzelfelt

Forwarded for your information and file are two copies of the Statement of Work for remedial investigation, feasibility study of suspected hazardous waste sites at Holloman Air Force Base, New Mexico.

When a draft work plan has been developed for remedial investigation of the sites at Holloman, your office will be notified of time and location for review and input to the work plan.

We appreciate your cooperation and input to the Air Force Installation Restoration Program. If you have any questions, please contact Mr. Mel Endicott at (214) 653-3328.

Sincerely

[Signature]

DUANE C. HELLEMBERGER, PE  
Deputy Director,  
Environmental Planning Division

Atch

(2) SOW

Copy w/o atch to:  
HQ USAF/LEEV  
HQ TAC/DEPV  
833 CSG/DEE  
CE MROED-EB (Stewart)  
Walk, Haydel & Assoc.  
(Fair)
1. We are writing to update you on the status of the Installation Restoration Program (IRP) at Holloman AFB, NM. IRP is a four phase program to identify and evaluate past hazardous material disposal sites on Air Force installations and control the migration of hazardous environmental contamination, if any, from such locations. The report of the Phase I records search at Holloman AFB was released in August 1983. Phase II is a multi-stage monitoring program to determine the nature and extent of contamination at these disposal sites.

2. Nine sites were initially scheduled for investigation in the Holloman AFB IRP Phase II Stage I. One site, the Base Exchange Service Station, was investigated separately under an accelerated program because of the potential safety hazards associated with site conditions. A report on the accelerated study was released on 23 May 1986. A field study of another site, where intermittent burning of small quantities of spent solvent was said to have occurred prior to the 1970s, was not done because the site could not be located nor could the reported activity be documented. The study of the remaining seven sites has been completed by the contracting firm, Dames and Moore. A copy of their final report is enclosed.

3. The field investigation consisted of installing and logging monitor wells and solid borings. Water and soil samples from the wells and borings were analyzed for total organic carbon.

4. The contractor has made recommendations for further investigation at four sites where indicators of contamination were found. A follow-up Remedial Investigation/Feasibility Study is being planned by the Environmental Planning Division at Headquarters, Tactical Air Command.
SCOPE OF SERVICES
FOR
REMEDIAL INVESTIGATION OF SUSPECTED
HAZARDOUS WASTE SITES
AT
HOLLOMAN AIR FORCE BASE, NEW MEXICO

CONTRACT NO. DACA45-86-C-0043
27 JULY 1987

1. Objective. The purpose of this work effort is to develop a Remedial Investigation to ascertain contamination at potential hazardous waste sites at Holloman Air Force Base, New Mexico.

2. Scope of Services. The Remedial Investigation shall be performed in accordance with "EPA Guidance on Remedial Investigation Under CERCLA" dated June 1985, as well as ER-1110-1-263 (in conjunction with "A-E Quality Management Procedures for Site Investigative Activities"). Specifically, the Remedial Investigation (RI) will: (1) confirm the presence or absence of contamination at designated sites; (2) utilizing the use of a two stage field activity approach, determine extent and degree of contamination at designated sites; (3) assess the potential for contaminant migration in the surroundings; (4) identify public health and environmental risk of contaminants relative to regulatory standards; and (5) define future investigations and/or actions required at designated sites/areas.

a. Literature and Information Search. The Architect-Engineer (A-E) will conduct a literature search of local hydrogeological conditions to complement/supplement the previous Phase I and Phase II - Stage 1 Reports. The A-E shall also perform an information search to gather information related to sites 53, 54, and 55, which were not included in the Installation Restoration Program Records Search for Holloman Air Force Base, New Mexico, August 1983. The files which are searched and the personnel interviewed as well as all the information gained shall be documented in all the Remedial Investigation Report submittals. The source of all information gathered as well as an estimate of its reliability shall be documented in the report. These tasks shall be performed before field investigations are begun at the sites in question. If information is obtained which may affect the investigations to be performed, the A-E shall contact the U.S. Army Corps of Engineers Project Manager (USACE PM) immediately to discuss possible changes in the planned field investigations. The literature and information search shall include but not be limited to the following topics:

(1) Interviews with base personnel familiar with the operation of and/or activities at each particular site.

(2) File search to obtain information regarding the operation of and/or activities conducted at the sites in question, especially those activities relating to the release of or investigation of the release of potentially hazardous substances.
(3) Topographic Data.

(a) Topographic Survey and Site Plan. The Architect-Engineer (A-E) shall perform all topographic surveys required for this project and shall supply this office with the original or a legible reproducible copy of the surveys and field books. The recommended project limits shall be defined from the topographic survey whenever possible. The anticipated areas to be surveyed are circled on Figure 1.

1. Horizontal and Vertical Control. Each survey shall be tied to permanent land monuments with assumed grid system and have this documented on the topo sheet and in the field book. The surveys shall be on National Geodetic Vertical Datum of 1929 with contours at a 1-foot interval. Set permanent vertical bench mark near but not onsite. Horizontal Control will be at a one-foot interval and vertical control will be at a 0.01-foot interval.

2. Limits and Scale. The surveys shall extend to the project limits. The scale of the survey shall be in accordance with the requirements for Site Plans in the Architect-Engineer Instruction Manual.

3. Physical Features. Each survey shall show all above ground and, where possible, underground physical features at the area surveyed (telephone, television, electric, water, sewer, etc.). The physical survey will also include the site's underground storage tanks, oil/grease separators, and the existing well locations as described in the Phase II - Stage I final reports, and the site specific information described in this Scope of Services.

4. Site Survey Layout. All bench mark locations and elevations should be shown. All the positions and coordinates of all permanent points within the control traverse of the site survey should be shown.

(4) Geologic Data.

(5) Hydrogeologic Data.

(6) Aquifer Data.

(7) Climatological Data.

(8) Biota Data.

(9) Analytical Data.

b. Plan Submittal Requirements/Approvals. The A-E, upon receiving his Notice to Proceed, shall prepare the Plans discussed below. These Plans shall include a detailed discussion of the technical approach the A-E plans to use to implement the requirements specified herein. All Plans must be reviewed and approved by the U.S. Army Corps of Engineers Project Manager (USACE PM) prior to commencement of that work effort.
(1) A-E Quality Control Plan (A-E QCP) and Sampling Plan (SP).

An effective working plan for chemical data quality control developed by the A-E. An A-E QCP will include the information outlined in the "A-E Guidance for Developing A-E Quality Management Procedures for Site Investigative Activities." Also, a Sampling Plan to address all field activities will be prepared. The Sampling Plan will contain a statement of sampling objectives; specification of equipment, analyses of interest, sample types, sample locations, frequency, and schedule. Use of field screening techniques to screen out samples that do not require off-site laboratory analysis shall be considered.


(a) General. Investigative activities associated with this project may pose unique safety and chemical exposure hazards which require specialized expertise to effectively address and eliminate. Accordingly, the Architect-Engineer (A-E) shall review the supplied project information and develop a site-specific Safety Health and Emergency Response Plan (A-E SHERP) which shall establish in detail the protocols necessary to protect on-site personnel, potential off-site receptors, and the environment from potential physical, chemical and/or biological hazards associated with the activities required by this scope of services. The A-E shall avoid providing material which is of a general nature and not specifically related to this project. Information readily available in standard texts should be repeated only to the extent necessary to make the plan self-sufficient. The A-E shall provide a draft SHERP to the Government for review and comment. Any comments shall be addressed and the results incorporated into a final plan and resubmitted to the Government prior to the commencement of any on-site activity.

Although this scope covers numerous sites it will not be necessary to submit a separately bound document for each site. Information that will apply to all sites, (for example medical surveillance, training, standard operating procedures etc.), may be presented in a general section. Information and procedures that may vary should be presented on a site by site basis.

(b) Regulatory Requirements. The A-E SHERP shall comply with the following regulations and reflect the guidance given in applicable guidance publications.


2. FAR Clause 52.236-13, Accident Prevention.


5. Other relevant regulations.
(c) **SHERP Topics.** The A-E SHERP shall address the following components as a minimum:

1. Staff organization, responsibilities, authorities and qualifications of key personnel and alternates responsible for health and safety.

2. Accident Prevention in accordance with EM 385-1-1, paragraph 01. A and appendix Y. List each activity, possible hazards, and procedures to eliminate the hazards or reduce the risk to an acceptable level.

3. General and site-specific training of personnel.

4. Frequency and content of medical surveillance.

5. Site control measures including site map, work zones, communication, security and site access.

6. Standard operating safety procedures, engineering controls and work practices.

7. Personal protective equipment specific to each of the site tasks and operations being conducted. Include types/materials, respiratory protection program and site-specific action levels to dictate upgrades/downgrades.

8. Personnel hygiene and decontamination facilities and procedures.

9. Equipment decontamination facilities and procedures.

10. Frequency and types of personnel and environmental monitoring including instrumentation, sampling techniques and analytical methods.


12. On-site first aid and emergency equipment.


14. Logs, reports, and record keeping related to implementation of the SHERP.

(d) **Examples of Guidance.** The following are examples of available guidance which can be used when formulating the SHERP (latest editions should be used):


3. TLV's - threshold Limit Values and Biological Exposure Indices for 1986-87, ACGIH (American Conference of Governmental Industrial Hygienists).


c. Field Investigations.

General. The investigative field work in this RI shall be performed in two stages. Stage I shall consist of installing wells as described under site specific paragraphs (see Table I). Stage II shall involve installation of additional monitoring wells if necessary at each site to provide sufficient information for performing a Feasibility Study for each site. An estimated number of wells which may be required at each site for Stage II field activities, is given in Table I in parenthesis. The values in Table I shall be used for the A-E's proposal. The actual number of wells which will be installed in Stage II shall be determined by the USACE based on information obtained from Stage I and recommendations by the A-E in the Stage 1 Technical Report. The Stage II well costs shall be identified in the A-E's proposal on a site-by-site or well-by-well basis.

1) Drilling Locations. The A-E shall be responsible for obtaining a digging permit from the BCE office before any drilling is started. The A-E shall also be responsible for protecting the site property and personnel from drilling operations and restoring each individual site to its original condition within five (5) days of when field investigations are complete for each stage at each site. The location of all soil and sediment samples shall be surveyed to some permanent landmark which is shown on the site plan so that the sampling location may be relocated at a later date.

2) Disposal of Drill Cuttings. The soil boring drill cuttings shall be evenly spread over the ground at Site 1 and at Site 31, where the borings are located outside the fire pit areas. At all the other soil borings, the drill cuttings shall be transported by truck or flatbed to the
landfill where it will be spread over the ground in a location the BEC designates.

(3) Drilling and Sampling Plan. A Drilling and Sampling Plan shall be submitted by the A-E for approval before any field work is begun. The Drilling and Sampling Plan shall include, at a minimum, the A-E's methods, equipment, and procedures for carrying out all field work including pore vapor testing, drilling, soil, sediment, and surface water sampling, well installation, well development, ground-water sampling, slug testing and decontamination procedures. All sampling and well locations for the Stage I field work shall be shown and the reasons for choosing those locations shall be explained. Any methodology to be used for determining locations in the field shall be included. This Plan shall also identify responsibilities of all personnel involved.

(4) Water Source. Water for drilling, steam cleaning and other necessary field activities will be made available by the U.S. Air Force. The A-E (or subcontractor) shall be responsible for collecting and transporting all water to the drilling areas for required uses. The A-E shall sample the water prior to using it on the first site and shall analyze it to determine the chlorine content in the water. The A-E shall also document the source location of the water. The A-E shall furnish all deionized water necessary to perform sampling operations.

d. Soil and Sediment Sampling.

General.

(1) Soil Sampling. Soil sampling shall be done with a split spoon sampler (ASTM D 1586-84) or thin wall sampler (ASTM D 1587-83) using standard sampling techniques. Sampling instruments shall not be chrome plated. Samples shall be obtained in the monitoring well boreholes and shall be used for logging purposes and geotechnical analysis as described in the appropriate paragraphs. Some samples may be used for chemical analysis as described under specific site paragraphs. A log shall be kept for each sampling location which shows the identification number, sampling location, method of sampling and sampling depth. A description, using the Unified Soil Classification System, of the materials encountered at each sampling location shall also be included in the log.

(2) Sediment Sampling. Samples of sediment shall be taken as described under the site specific paragraphs below. The A-E shall propose methods and procedures for obtaining sediment samples in the Drilling and Sampling Plan. These samples shall be analyzed for the chemical constituents described in the appropriate paragraphs and their physical characteristics shall also be visually described.

(3) Sample Handling. The volume of a sample recovered shall be great enough to provide the necessary sample volume for the required chemical analyses. All sampling devices and decontamination procedures shall be performed in a manner consistent with the most recent EPA guidelines. All methods and procedures shall be included in the Drilling and Sampling Plan.

e. Monitoring Well Installation and Sampling. (See figure 2.)
General Requirements.

(1) The design and construction of all monitoring wells shall be such that each well shall yield representative ground-water samples for chemical analysts and allow for the accurate measurement of ground-water elevations. All state and local certification requirements shall be met. The A-E shall be responsible for obtaining any well drilling permits required by state or local authorities and for complying with state or local regulations concerning submission of well logs and samples. The Base Civil Engineers office shall issue to the A-E any Base required/appropriate drilling or digging permits necessary for the implementation of the field work.

(2) The A-E shall provide a qualified geologist or geotechnical engineer who shall be on site for all drilling, installations, development and testing operations. The A-E shall use a drilling method consistent with the intent of the monitoring well program. The proposed drilling method shall be submitted in the Drilling and Sampling Plan.

(3) Protection of Water Yielding Zones. The use of contaminating additives as part of the drilling fluids is not permitted. Grease or oil on drill rod joints is not permitted. Dispersing agents (such as phosphates) or acids shall not be used in well installation or development. There shall be no attempt to chemically disinfect the well. The drill rig or rigs, drill tools, and associated equipment shall be cleaned with steam prior to commencement of drilling at each well location. It is expressly understood that toxic and/or contaminating substances shall not be used during any part of the drilling, well installation, or well development process. All drilling activities and methods shall be sufficient to positively prohibit the introduction of contaminants from one water bearing zone to another via the well bore.

f. Soil Sampling for Geotechnical Analysis.

(1) Sampling Intervals. During drilling, the geologist or geotechnical engineer and crew shall collect soil samples for geotechnical analysis as outlined below.

(a) Soil samples shall be taken every 2.5 feet for the first 10 feet, then at 5-foot intervals or at changes in material to the end of the boring.

(b) 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.

(c) Samples shall be stored in plastic jars or glass jars by the A-E until such time as they are needed for testing or the contract is complete.

(d) All soil samples shall be visually classified by the Unified Soil Classification System. The A-E shall verify the classification by laboratory analyses consisting of the following, if they are applicable:
Grain-Size Distribution (ASTM D 421 & 422)  
Atterburg Limits (ASTM D 4318)  
Moisture Content (ASTM D 2216)

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

g. Well Design.

(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.

(2) Riser. Well riser shall consist of new threaded, flush joint, poly-vinyl chloride (PVC) pipe. All well risers shall, as a minimum, conform to the requirements of ASTM F 480-81 SDR 13.5 (schedule 40) for 2-inch diameter pipe and shall bear markings that will identify the material as that which is specified and shall carry the seal of the National Sanitation Foundation. All wells shall have a minimum 2-inch inside diameter.

(3) Screen. The well screen shall be 15 feet in length and constructed of the same size and strength PVC material as the well riser. The screen shall be non-contaminating, factory slotted or of continuous wrap design. Field slotted screen is not permitted. The slot size shall be determined by the A-E and designed to be compatible with aquifer and gravel pack material. Screen locations and actual borings will depend on the elevation of the water table. For estimating purposes, approximate depths have been outlined in Table 1 using information from other work performed in the area.

(4) Screen Location. The A-E shall have the responsibility of selecting the screened area of the borehole so that the completed monitoring well functions satisfactorily. The screen shall be placed across the water table so that any non-aqueous phase floating on the water table surface may be detected and measured. Normal, seasonal fluctuations in the water table elevation shall be taken into consideration when placing the well screen so that monitoring will be possible throughout the year. Normal fluctuations shall be determined through a review of local well records and available literature. The procedure to be used in the field for determining the screen placement shall be presented in the A-E Sampling Plan.

The annular space around the well screen shall be backfilled with a clean, washed, silica sand sized to perform as a filter between the formation material and the well screen.

(5) Joining Riser. Riser sections shall be joined by threaded, flush joint couplings, to form water-tight unions. No lead shot or lead wool is to be employed in producing seals at any point in the well.
(6) **Vertical Alignment of Wells.** All risers shall be set round, plumb, true to line. A 5-foot long section of pipe 1-3/4 inch in diameter shall be run through the entire length of the well to check the alignment. The performance of this test shall be documented in the A-E QCP report and daily reports. If this test cannot be passed the well will not be accepted.

(7) **Grout Seal.** In wells with screens placed above the water table, a minimum two (2) foot thick seal, consisting of bentonite pellets and powder shall be placed into the annular space above the well screen and filter sand. The hydration time for this seal shall be at least eight (8) hours. Cement grout shall 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 7 gallons of clear water per bag of cement (94 pounds). Three percent by weight of bentonite shall be added if permitted by State regulations. As an option, a minimum two foot thick layer of fine sand (very fine well graded silica sand) shall be used in lieu of the bentonite seal. The grout shall be placed above this sand layer to the ground surface.

(8) **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 (Figure 2). The PVC well shall be enclosed in a steel protective casing. The elevation of the PVC riser shall be limited to the elevation requirements of the protective locking cap, that has been determined by the Base Civil Engineer's (BCE) office. The steel casing shall be at a minimum, four (4) inches in diameter and shall be provided with a locking cap and lock. All locks shall be keyed alike. The locks on existing wells which are monitored under this scope of work shall be exchanged so that all wells will have the same locks. Six keys will be furnished to the BCE office upon completion of field activities and keys for existing wells may be obtained from the BCE's Office. A minimum three (3) foot square, four (4) inch thick concrete pad, sloped away from the well, shall be constructed around the well casing at the final ground level elevation. Three (3) 2-inch diameter or larger steel posts shall be equally spaced around the well and embedded in the concrete pad. The specific sites these posts can be installed are outlined in the site specific sections of this scope. The ground immediately surrounding the top of the well shall be sloped away from the well. Some wells may be required to be finished flush with the ground or pavement if they are in areas of heavy traffic. Flush finished wells shall also be equipped with locks and shall be protected from the entry of surface fluids into the well. The flush mount sites are addressed in the site specific sections of this scope.

(9) **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.

(10) **Well Construction Logs.** Suitable logs detailing construction practices shall be maintained for inclusion in the Engineering Report.
Copies of the field logs shall be included in the draft Engineering Report and final drafted boring logs shall be submitted in the final Engineering Report. The logs shall be prepared by a qualified geologist or geotechnical engineer present during all drilling operations. The original and one (1) copy of each field well construction log shall be completed and sent to the USACE PM within 10 days of well completion. One copy of each final field log shall be sent to the State Engineer's Office. The well will not be accepted by the USACE PM until the logs are received and approved. Information provided in the logs shall include, but not be limited to, the following:

(a) Reference elevation for all depth measurements.

(b) Depth of each change of stratum.

(c) Thickness of each stratum.

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

(e) Depth interval from which each formation sample was taken.

(f) Depth at which hole diameter (bit sizes) changes.

(g) Depth at which ground-water is first encountered.

(h) Depth to the static water level and changes in static water level with well depth.

(i) Total depth of completed well.

(j) Depth or location of any loss of drill water circulation, loss of tools or equipment and any other problems encountered.

(k) Location of any fractures, joints, faults, cavities or weathered zones.

(l) Depth of any grouting or sealing.

(m) Nominal hole diameters.

(n) Amount of cement used for grouting or sealing.

(o) Depth and type of well casing.

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

(q) Any sealing-off of water-bearing strata.

(r) Static water level upon completion of the well and after development.
(s) Drilling date or dates.

(t) Construction details of monitoring well including grain size and source of well filter pack material and location of all seals and casing joints.

(11) Well and Monument Locations. Coordinates and elevations shall be established for each monitoring well. The coordinates shall be to the closest 1.0-foot and referenced to the State Plane Coordinate System. If the State Plane Coordinate System is not readily available, an existing local grid system shall be used. A ground elevation to the closest 0.01-foot and an elevation for the top of the casing to the closest 0.01-foot shall be obtained at each well. These elevations shall be referenced to the National Geodetic Vertical Datum of 1929. (Two (2) permanent control monuments shall be placed in accessible locations within the limits of the work. These monuments shall be set no closer than 500 feet to each other.) Coordinates and elevations shall be established to the closest 0.01-foot for each monument. The location, identification, coordinates and elevations of the wells and monuments shall be plotted on maps with a scale large enough to show their location with reference to other structures at the individual sites. A tabulated list of the monitoring wells and monuments, copies of all field books, and all computation sheets shall be prepared and submitted to the COE PM, Omaha District, ATTN: CEMRO-ED-EB. The tabulation shall consist of the designated number of the well or monument, the X and Y coordinates, and all the required elevations. These items shall be submitted to Omaha District no later than the Pre-Draft Remedial Investigation Report completion date.

(12) Identification of Wells. The A-E shall affix a permanent marking or tag to the outer steel protective casing of each well which clearly identifies the well number, the U.S. Army Corps of Engineers - Omaha District, verbage which states that before removal or modification to the well, the Base Civil Engineer's office must be contacted, and the adjusted top casing elevation.

(13) A-E Responsibility for Monitoring Wells. It is the responsibility of the A-E to properly plan, design, install, develop, and test monitor wells so that they are suitable to produce representative ground-water samples in sufficient quantity and quality for geochemical testing. The A-E shall ensure that the intentions of this Scope of Work and best construction practices are carried out.

(a) If the A-E, due to inadequate design or construction, installs monitoring wells that are not functional or not in accordance with specifications, the USACE PM will disapprove the well and direct the A-E to repair or replace it at the USACE PM's direction. This work shall be done at no additional cost to the Government.

(b) If a monitoring well is disapproved by the USACE PM or is abandoned by the A-E for any reason, the hole shall be backfilled with neat cement grout from top to bottom by the A-E at no additional cost to the Government.

(14) Well Development. Within 2 weeks after each well has been constructed, but no sooner than 48 hours after grouting is completed, the
A-E shall direct a program for the development of the well by pumping and/or surging and bailing, without the use of acids, dispersing agents or explosives. Development shall continue for a period of four (4) hours (minimum) and until ground-water removed from the well is clear and free of sand. The pH, temperature, and specific conductivity of the ground-water shall be monitored periodically during development. If the water is still cloudy at the end of the 4 hours but these parameters have stabilized, then the well shall be considered developed.

At least as much water as was introduced during drilling shall be removed from the well. 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 A-E shall collect approximately one (1) liter of water from the well in a clear glass jar, label and photograph it with a 35 mm color slide, and submit the slide as part of the well log. The jar shall be properly backlit to accurately show the condition of the water. The nephelometric turbidity shall also be measured in accordance with ASTM D 1889.

Wells at the BX Gas Station - Site 17 shall be surged only, until little or no sediment enters the well, and all sediment which enters the well shall be removed. Then a minimum of two volumes of water shall be removed to assure that the well is in good contact with the geologic formation. All water removed from these wells shall be collected and discharged to the oil/water separator that is designated by the BCE office.

(15) Insitu Permeability Determination. After development of monitoring wells, the A-E shall determine for each the insitu permeability of the uppermost water bearing stratum in accordance with "Methods of Determining Permeability, Transmissibility and Drawdown," USGS Water Supply Paper No. 1536-1, 1963. However, no water or other liquid may be introduced into the well other than formation water from that well.

(16) Ground-water Levels. After all the wells at Stage II sites are installed and developed and all water levels have reached their static level, then water level measurements shall be taken in all wells including the existing wells at each site. Measurements shall be taken within a period of 24 hours. Any non-aqueous layers shall also be measured. Ground-water elevations shall be corrected for depression by the non-aqueous phase when necessary to determine the true ground-water elevation.

(17) Ground-water Samples. Each of the ground-water monitoring wells shall be sampled once. Before a sample is collected from a well, the water level and well depth shall be measured and recorded. The presence of any non-aqueous phase shall be determined and measured if present. The method used shall be approved in the Sampling Plan. Then the well shall be pumped or bailed with clean equipment to remove a quantity of water equal to at least five (5) times the submerged volume of the casing. If the well does not recharge fast enough to permit removing five (5) casing volumes, the well shall be pumped or bailed dry and sampled as soon as sufficient recharge has occurred. At sites where a non-aqueous phase is encountered (except the BX Gas Station) one sample of the non-aqueous phase shall be obtained from one well for laboratory analysis as required for that site. A sample of the water below the non-aqueous phase shall be obtained from all the wells (except at the BX Gas Station). Methods and equipment shall
be proposed in the Drilling and Sampling Plan. An additional sample is provided in the tables for five of the sites being investigated.

h. Analytical Plan.

(1) General Analysis of Ground-water Samples. Ground-water samples taken from properly developed monitoring wells shall be analyzed by the following EPA methods. These methods are described in detail in EPA SW-846, September 1986 (3rd Ed.) or where indicated, EPA 600/4-79-020. Method detection limits shall be defined in accordance with the respective EPA method unless otherwise specified.

Samples taken for volatile organics (VOA) shall be analyzed by 8240. Efforts should be made to minimize losses due to handling. Samples vials must contain no headspace.

Semivolatile compounds (Acid/Base/Neutral Extractables) shall be analyzed by 3510 or 3520 followed by 8250 or 8270. Specified extract cleanup methods shall be performed where necessary to obtain appropriate detection limits.

Total Recoverable Petroleum Hydrocarbons (TRPH) shall be analyzed by method 418.1 (600/4-79-020).

Total Recoverable Metals (to include the Priority Pollutant Metals and RCRA Metals) shall be analyzed by 3005/6010 with the addition of method 7470 for the analysis of mercury. Metals to be analyzed are detailed in EPA 6010 and include antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, sodium, thallium, and zinc. Additional methods 7060 and 7740 for arsenic and selenium, respectively, shall be used if method detection limits in 6010 are not appropriate. Where specified, lead shall be analyzed by 3005/7421 with a detection limit of 1 ug/L (1 ppb).

Common anions shall be analyzed by EPA method 300.1 using ion chromatography (600/4-79-020).

The pH shall be monitored in the field by an appropriate method.

(2) General Analysis of Soil and Sediment Samples. Soil and sediment samples shall be analyzed by the following EPA methods. These methods are described in detail in EPA SW 846, September 1986 (3rd Ed.) or where indicated, EPA 600/4-79-020. Method detection limits shall be defined in accordance with the respective EPA method unless otherwise specified. Soil sample results shall be presented on a dry weight basis.

Samples taken for volatile organics (VOA) shall be analyzed by 8240. These samples shall not be composited and an effort should be made to minimize losses due to handling.

Semivolatile compounds (Acid/Base/Neutral Extractables) shall be analyzed by 3550 followed by 8250 or 8270. Specified extract cleanup methods shall be performed where necessary to obtain appropriate detection limits.
Samples to be analyzed for Total Recoverable Petroleum Hydrocarbons (TRPH) shall be extracted by 9071 through 7.11, followed by infrared analysis as specified in 418.1 (600/4-79-020).

Total Metals (to include the Priority Pollutant and RCRA Metals) shall be analyzed by 3050/6010 with the addition of method 7471 for the analysis of mercury. Metals to be analyzed are detailed in EPA 6010 and include antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, sodium, thallium, and zinc. Additional methods 7060 and 7740 shall be used for arsenic and selenium should lower detection limits be specified. Where specified, lead shall be analyzed by 3050/7421.

3) Calibration Procedures/Frequency. Calibration of the analytical instrumentation to be used for this project are outlined in the A-E Quality Control Plan (A-E QCP). Calibration requirements and associated frequency are to be defined.

4) Matrix Spike Analysis. Matrix spike sample analysis shall be run on one (1) in twenty (20) for all water and soil parameters. Methods requiring a greater rate of spike analysis shall be followed explicitly.

5) Data Validation. Data validation for this project will be performed by the Contractor. A plan for this activity will be proposed in the required A-E QCP.

6) Sample Containers/Coolers. The A-E shall furnish all material and equipment necessary to obtain all of the required samples. This includes the sample bottles, preservatives, ice bags, and coolers for the Contract Laboratory as well as the Government Quality Assurance Lab. The coolers used for shipping the QA samples will be returned to a destination indicated by the A-E.

7) Preservatives/Holding Times. Recommended sample containers, preservatives, and holding times for water and soil samples are outlined in Tables 2 and 3, respectively. No samples shall be held on site for more than 24 hours. The A-E shall provide specific details in the A-E QCP.

8) Quality Assurance/Quality Control Samples.

(a) Quality Assurance (QA) samples shall be sent to the designated QA laboratory for this project. Please consult the USACE PM for the name and address of this lab. These samples will consist of splits and field blanks as specified in the U.S. Army Corps of Engineers (USACE) Sample Handling Protocol dated October, 1986. This guidance is to be followed explicitly. The Contractor may use his own "chain-of-custody" and "request-for-analysis" forms when submitting those samples.

(b) Quality Control (QC) samples shall be collected and analyzed by the contract lab. For water and soil samples, one (1) duplicate and at least one (1) field blank shall be taken in the field for every ten (10) field samples. Field blanks shall consist of sample rinsates and trip blanks. (Note: trip blanks shall be taken only for volatile organic analysis and should not be opened in the field.)
Projected sampling breakdowns are outlined in the respective attached tables, 4-10.

(9) **Contractor Laboratory Approval.** The A-E contract lab must be approved by the Government. The A-E shall inform the USACE-PM, as early as possible, which analytical lab will be used to perform the analysis, along with an A-E Laboratory Quality Management Plan (A-E LAB QMP). This is an off-the-shelf brochure most laboratories have describing their personnel's qualifications, equipment, analytical capabilities, quality control program, sample handling and storage, chain-of-custody procedures, sample and analysis tracking system, reporting, etc. The A-E Lab QMP will supply much of the information needed in the A-E QCP and prepare the government QA Lab for determining the acceptability of the A-E Lab. A-E Lab approval often involves the analysis of matrix-specific performance evaluation samples and a laboratory inspection. Only those analyses deemed successful by the USACE shall be paid for under this contract.

1. **Field Activities - Stage 1 Drilling and Sampling Technical Report.**

(1) The purpose of this technical report is to gather all site specific data and analyses in one report (except the BX Gas Station site) to determine if further individual site investigation is needed to define the extent of the contamination(s). This technical report shall analyze each site investigation and recommend further field activities necessary to determine the extent of any contamination(s). This report shall contain the following information, but not be limited to:

(a) Monitoring wells containing floating product and the amounts.

(b) Analytical results.

(c) Direction of ground-water flow.

(d) Results of pore vapor analyses.

(e) Preliminary determination of extent of contamination at each site.

(f) Recommendations for additional investigations required to complete the remedial investigations report.

(g) Any changes in methods or procedures of the Drilling and Sampling Plan to better characterize the conditions at each site.

j. **Site Specific Investigations and Chemical Analysis.**

(1) **Site 1 - Main Base Landfill.**

(a) The existing Main Base Landfill (Figures 1, 3, 4, and 5) occupies an area of 160 acres just north of the main base area. The landfill has been in operation since 1958, using a trench and fill disposal method.
According to the Phase I report, small quantities of waste oil, solvents and pesticides have been disposed of at this site. More typical fill includes domestic solid waste and nonhazardous solid waste materials from the industrial shops. Base maps indicate that rubble was also disposed of at the site.

Three monitoring wells were installed at the site to depths of from 34 to 58 feet. Their locations are shown on pages 22 and 23 of the Final Phase II - Stage 1 Report, 6 March 1987. Split spoon samples were recovered at selected intervals during drilling. The predominant subsurface material encountered at this site was pink to tan gypsum clay with some silt and fine sand. The relative proportions of these materials varied with depth, and correlations between borings could not be made.

The thickness of the unsaturated material overlaying the water table decreases from 37 feet at the north end of the site to 15 feet at the south end. The magnitude of the ground-water gradient remains fairly constant at about 0.002 ft/ft. The regional southwesterly direction appears to be modified locally by a drainage ditch. The available data indicate that the gradient is to the south-southeast at the northwest end of the site, to the southeast at the west-central end of the site, and to the southwest at the southwestern end of the site. The low gradient and fine textured nature of the material at the site indicate that ground-water velocity is very low.

(b) Monitoring Wells. Five (5) new monitoring wells shall be installed around the landfill to establish ground-water flow directions and to determine the presence of contamination found in earlier investigations. All monitoring wells and protective casings at this site shall extend above the ground 2-3 feet with the protective casing painted bright yellow. The protective posts shall also be installed for each well. Suggested well locations are shown in Figure 3. Four (4) additional wells may be installed at a later date in the project, based on observations and analysis of the five Stage I wells. The four (4) additional wells (Stage II) will be installed at this site based on analysis of Stage I wells. The A-E shall make recommendations for placement of additional wells in the Drilling and Sampling Technical report.

(c) Landfill Cap Evaluation. The condition and/or existence of any cap material on the landfill shall be investigated. This shall consist of obtaining undisturbed samples, taken according to ASTM D 1587-83, of the cap material at six locations which are representative of the conditions across the landfill. These samples shall be obtained from the interval below the ground surface most representative of the cap material. The borehole at each sampling location shall be extended to the top of the debris to determine the cap thickness. These boreholes shall be backfilled using a bentonite or other impermeable backfill approved by the COE PM. Permeability tests shall be conducted on these samples in accordance with USACE EM110-2-1906. These materials shall be classified using the Unified Soil Classification system and laboratory analyses described in paragraphs 2.f.(1)(d) and 2.f.(2).

(d) Chemical Analyses. After installation, all monitoring wells, new and existing, shall be sampled for chemical analyses. Sampling procedures are discussed in paragraph 2.h.(1) and projected sampling breakdown outlined in Table 4. Analyze for the following:
1. VOA.
2. TRPH.
3. A/B/N Extractables.
4. Total Recoverable Metals.
5. Common Anions.

(2) Site 17 - BX Service Station.

(a) The BX Service Station is located in the densely populated main base area (Figures 1, 6, 7, 8, 9, and 10). The Base Hospital and an elementary school are 420 and 600 feet away, respectively. The service station has been in its present location since the early 1950's. Some of the below-ground storage tanks currently being used were installed more than 20 years ago. In January 1981, discrepancies in MOGAS storage tank inventories were noted (CH2M Hill, 1983). Subsequent excavation of the area around the tank showed that fuel had leaked from these lines. An estimated 100,000 to 150,000 gallons had been leaked from the lines.

In February 1981, test borings drilled around the station to assess the extent of gasoline contamination showed a pool of free gasoline, up to 4 feet thick, on top of the water table, which is at a depth of 6 to 10 feet below the ground surface (El Paso Testing Laboratories, 1981). Two recovery wells were installed in the area of maximum gasoline thickness, and 5,500 gallons of liquid were removed using a buoyancy float-activated skimmer pump system. Analysis indicated that the removed product was 95 percent water. Since the 1981 test pumping, no further removal of gasoline-contaminated water has been attempted until January 1987. The Base Civil Engineer's office had contracted a company to install recovery wells so to begin pumping off the product. CPT Kimbrell of the Civil Engineer's Office has been performing the product recovery work on a random schedule. On a monthly basis CPT Kimbrell has been analyzing the gasoline product plume with measured readings of water elevation and product elevation at certain well locations and he is the point of contact for information on the recovery project.

The underground fuel lines have been replaced with fiberglass lines to reduce the potential for future leakage. A tank pressure testing program has also been implemented, and at the present time, the underground fuel storage system is considered to be in satisfactory condition.

(b) The A-E shall evaluate current conditions at the BX Service Station Site and make recommendations for maximizing continued removal of gasoline from below the ground surface.

Tasks to be covered in this scope of work include Investigations:

1. Examine past reports and other available data
(operating logs, specifications for construction of gasoline removal facilities, etc.).

2. Examine present operating procedures of the gasoline removal facilities, the volumes and rates at which gasoline is being removed.

3. Measure water levels and gasoline thicknesses in all the monitoring and pumping wells in the vicinity of the service station (approximately 18 wells). Measurements shall be taken on two different dates at least 2 weeks apart. All measurements on the two different dates shall be made within a 24-hour period. This data shall be gathered during periods of "typical" operation and the operating status of the gas removal facility during the data gathering period shall be documented.

4. A pore vapor analysis shall be conducted along the vicinity of the sewer lines which pass through the documented area of the gasoline plume. Specifically, tests shall be made along the 10" sewer which runs from the sewer lift station on First Street to the hospital, the 6" sewer which parallels First Street, the six (6) inch gas line which parallels First Street, and the two (2) inch gas line which runs south from the gas station into the housing area. Approximately 25 stations or testing points are anticipated for this task. The A-E will propose in his Sampling Plan the depths, techniques, and locations of analysis based on the utility information that is available from the BCE office. If results of analysis appear to be inconclusive, the USACE Project Manager shall be contacted for further direction. Analysis points shall consist of some background samples which shall be used to determine the effectiveness of the method used. See paragraph 2.j.(3)(b) for additional requirements regarding the pore vapor analysis.

5. After the pore vapor analysis has been performed the A-E shall take measurements in existing wells to determine the plume thickness, and submit to the USACE Project Manager a plan view of the pore vapor locations and their readings including the well measurements of plume thickness. From this initial analysis the A-E shall recommend the locations of the three (3) monitoring well installations. The three well locations will be approved by the USACE prior to installation. An additional three (3) monitoring wells may need to be installed at a later date based on observations of the installed three (3) wells.

6. Reevaluate the effectiveness of the present monitoring locations.

7. One set of readings of all the sewers and other underground facilities in the area for explosion hazard shall be taken and analyzed.

8. The casings shall be modified on the existing monitoring wells, listed below, so that no casing extends more than six (6) inches above the ground surface. Each protective casing shall be topped with a locking cap and the inner well casing shall have a slip-on cap. Precautions shall be taken to insure the integrity and quality of all the wells during this work (PVC shavings shall not be allowed down the well, etc).
Well W-3, in its present condition, may become a conduit for contamination to enter the ground water. W-3 has a slip-on cap (not tightly fitting) which is flush with the gas station driveway. It shall either be equipped with a locking, flush mounted cap or grouted closed with a neat cement grout and replaced with a new well that is equipped with such a cap. The A-E shall evaluate the feasibility of these two options and shall choose the most cost effective option which will insure the integrity of data gathered from the well.

If W-3 requires replacement then an optional location shall be determined and recommended. The A-E shall provide written recommendations to the USACE Project Manager for approval before beginning such work.

A protective locking casing shall be installed on Well TH-14 to insure its integrity. At present the well consists simply of an unprotected PVC pipe with a slip on cap. The protective casing shall be installed six inches to one foot below the ground surface and grouted into place. The elevation of the PVC pipe shall be reduced to ensure that the steel locking cap elevation does not exceed the six-inch limit.

The existing BX Gas Station Monitoring Wells (installed under previous studies) are listed below:

W-2
W-3
W-4
W-5
TH-3
TH-6
TH-14
TH-15
TH-16
TH-20
TH-22
EPTL

2. A third round of water table elevations and gasoline plume thicknesses shall be obtained after all new monitoring wells have been installed and have stabilized (not sooner than 2 weeks after installation).

(c) The A-E shall:

1. Determine the risks associated with any explosion hazard encountered during monitoring of underground utilities and make recommendations for remediating such hazards and shall recommend any additional monitoring which may be necessary.

2. Create water table elevation and gasoline plume thickness maps from the data gathered under this scope of work. These figures should consist of surface contours versus top of the product versus the elevation of the water table, and three-dimensional figures showing the cone of depressions of the product and water elevations. The main cross sections showing the largest thicknesses of the product shall also be
presented in the analysis report. These cross sections shall also illustrate the plume characteristics in critical areas near existing pumping centers and shall typically illustrate the plume characteristics.

3. Compare the present plume configuration with past configurations (BX Service Station Stage II Phase I). The effect of pumping on the plume, the size of the well installation and the rate of pumping, and direction of movement shall be discussed.

4. The effectiveness and efficiency of the present gasoline removal activities shall be determined after examining the plume configuration and operating procedures and records. Recommendations shall be made for increasing the efficiency of future operations, installation of additional removal facilities, including locations, type of facility and operating procedures as well as monitoring requirements. Recommended removal rates will be based on minimizing gasoline entrapment in the soil matrix.

5. Recommendations for additional ground-water treatment if necessary.

6. Reevaluate volume of subsurface gasoline remaining.

(d) A separate Draft Technical Report for the BX Service Station will be presented to the USACE within twenty-one (21) days of the A-E's field activities completed at Site 17. Upon the USACE review and comments, a Final Technical Report will include but not be limited to:

1. Site History.

2. Site Geology and Hydrogeology.

3. Project Objectives.

4. Discussion of current and past gasoline removal operating procedures.

5. Site Investigations.
   a. Description.
   b. Problems encountered and resolution.
   c. Discussion of data gathered (data synopsized in text with all data presented in Appendixes).

6. Plume movement and size.

7. Associated risks.

8. Conclusions and recommendations.
   a. Changes in present recovery system.
b. Additional recovery well locations, types of wells, rates of recovery for each recovery well site, etc.

c. Monitoring recovery rates, maintenance and safety precautions for well operations.

(3) Site 31 - Fire Department Training Area (FDTA).

(a) The Fire Department Training Area, located north of the Main Base Area (Figures 1, 3, and 11), has been in use since the base was activated in 1942. Prior to 1979, waste oils, solvents, and fuels were obtained from base industrial shops. Since 1979, only new fuel has been used in the training exercises, and runoff from the exercises is collected in an oil/water separator that was installed in 1979. The area consists of two enclosures used for fire training.

Current procedures incorporate presoaking the gravel-lined area with water before fuels are applied and ignited. It is probable that some of the unconsumed fuel percolates into the underlying soils and possibly to the water table. The training pit is located approximately 400 feet from the nearest surface drainage ditch.

Two soil borings were installed to depths of 11.5 feet each, and one monitor well was installed to a depth of 38 feet at Site 31. Boring 31B1 was located at the center of the southwest training area, 31B2 at the center of the northeast training pit, and monitoring well 31W1 was located near the oil/water separator. Soil samples were collected in all three holes at the surface and at depths of 2.5, 5, 7.5, and 10 feet. Subsurface materials could not be clearly correlated between the three holes on the site. Subsurface materials encountered included tan or pink gypsum clay with some silt and/or sand. Some black clay and caliche were encountered near the surface at 31B1. A slight fuel odor was noted in the sample from 5 to 6.5 feet in Boring 31B2. An odor and visual evidence of oil were noted down to 9 feet in Boring 31B1, and odor was noted in 31W1 from the cuttings from 22 to about 30 feet.

Water was found at 20 feet below the ground surface in well 31W1. The direction of ground water flow appears to be influenced by the drainage ditches near the site and is probably to the south-southeast.

(b) Pore Vapor Analysis. The A-E shall conduct a pore vapor analysis in the area of the Fire Department Training Area. The purpose of this analysis shall be to determine locations for the placement of monitoring wells which will help to define the location of any contaminant plume and to determine in which direction it may be moving. An organic vapor analyzer with Flame Ionization Detector (FID), or Photoionization Detector (PID) shall be used. The method used to extract the pore vapor from the ground, locations, and depths shall be proposed by the A-E in the Drilling and Sampling Plan. Approximately 30 sampling stations are anticipated.

The final two (2) pore vapor analysis measurements to be obtained shall be taken adjacent to two of the monitoring well locations. One shall be taken in an area where high vapor levels are measured and the other shall be taken in an area of low or no vapor measurements. These values
shall be used for comparison with actual water sample analyses from the adjacent monitoring wells as an attempt at calibrating this activity.

(c) **Monitoring Wells.** Four (4) monitoring wells shall be placed in this area to define the extent of any contaminant plume which may be due to activities at the Fire Department Training Area. The locations shall be chosen based on results of the pore vapor analysis. Regional ground-water gradient is reportedly to the southwest, however, there may be flow to the southeast locally. Placement of the monitoring wells shall aid in determining this. Monitoring wells at this site shall be completed 2 to 3 feet above the ground surface. The protective casings and posts shall be painted yellow. Four (4) additional wells may be required at this site for Stage II field activities based on the analysis and recommendations in the Technical Report.

(d) **Soil Sampling.** Two borings shall be advanced into the FDTA pits, one in each pit. Split spoon samples shall be taken at the ground surface, 2.5, 5, 10, 20, and 30 feet below the ground surface.

(e) **Sediment Sampling.** Four samples of the sediment in the drainage ditch closest to the site shall be taken. One sample shall be in an updrainage location and the remainder of the samples shall be taken downgradient of the site. These samples shall aid in determining the importance of the drainage ditch as a contaminant migration pathway.

(f) **Chemical Analysis.** The soil samples, the sediment samples, and the ground-water samples shall be analyzed as outlined in Table 5A and 5B, and are listed below:

1. VOA.
2. B/N Extractables.
3. TRPH.
4. Lead.

(4) **Site 50 – Building 301, Aircraft Maintenance Hangar.**

(a) Site 50 is located on the south side of Building 301 (Figures 1, 5, and 12), a hanger that is used intermittently for equipment repair. This site was not discussed in the Phase I report but subsequently was added to the Phase II – Stage 1 program. Concern about the site developed when liquid hydrocarbons were found on the water table during an exploratory excavation for a sewer line. Two separate hypotheses have been postulated to account for the presence of hydrocarbons at this location. Base personnel suspect that oil may be coming from fuel spills from aircraft on the concrete area west of Building 301. Another possibility is leakage from a 15,000-gallon precast concrete tank south of Building 301, used to contain heating oil. Although this tank is no longer in use, it may contain residual heating oil. A corner of this tank was unearthed during excavation for the sewer line.

One monitoring well and one soil boring were installed at this site to depths of 19 and 22 feet, respectively. Split spoon samples were taken at
2.5, 5, 7.5, 10, and 15 feet in both holes. A fuel odor was noted in all samples. The subsurface material at the site was predominantly sandy clay with some interbedded gypsum. A very soft layer was encountered near the water table.

The ground-water gradient at the site cannot be determined precisely with only one well. However, nearby wells indicate that ground-water flows towards the southwest with a gradient of about 0.003 ft/ft. Depth to the water table at the site is about 5 feet.

(b) Monitoring Wells. Four (4) monitoring wells (Stage 1) shall be installed in the area on the south side of Building 301. Suggested locations are shown in Figure 12. These wells shall provide an idea of ground-water flow direction and concentrations of possible contamination. The location of the tank shall be taken into consideration when locating the monitoring wells. An additional three (3) monitoring wells (Stage 2) may be installed at this site after analysis is performed on the Stage 1 wells. The A-E shall make recommendations on the necessity and possible locations for additional monitoring wells in the Stage I Technical Report. All the wells at this site shall be flush mounted with the pavement.

(c) Soil Sampling. Soil samples taken in the monitoring well boreholes at depths of 2.5, 5, and 10 feet below the ground surface shall be tested for chemical analysis.

(d) Location of Precast Concrete Tank. Small diameter shallow probe holes shall be drilled on a ten-foot grid pattern in the area believed to contain the 15,000 gallon concrete tank. The intent of this activity is to determine the actual location and configuration of the tank.

Once this has been determined, a boring shall be placed adjacent to the tank (as close as is safe and feasible) and soil samples taken at 2.5 foot intervals to a depth of 15 feet or at least 2 feet below the approximate bottom of the tank, whichever is deeper. The three samples with the highest OVA readings shall be sent to the lab for chemical analyses. Water levels and presence of odors and free fuel shall be noted if encountered.

(e) Chemical Analysis. Ground-water samples and soil samples as outlined in Table 6 shall be analyzed for the following:

1. VOA.

2. A/B/N Extractables.

3. TRPH.

(5) Site 51 - Old AGE Refueling Station.

(a) This site is located on Delaware Street south of the parking lot of Building 295 (Figures 12 and 13). During utility construction, fuel was found floating on water in a ditch that was newly excavated.

Monitoring well 51W1 was installed to a depth of 19.5 feet at this site, and soil boring 51B1 was completed at 16.5 feet. Split spoon samples
were taken in both holes at 2.5, 5, 7.5, 10, and 15 feet. A fuel odor was noted to a depth of 8 feet in 51W1 and to 6 feet in 51B1. Subsurface materials at the site consisted of gray, brown, and/or yellow silt clays with some sand down to 7 feet and tan or pink gypsum, fine sand, and/or clay to 15 feet. Depth to ground-water at the site was 5 to 6 feet at the time of measurement in September 1984.

(b) Monitoring Wells. Five monitoring wells (Stage I) shall be installed in the area of the Old AGE Refueling Station. Suggested locations are shown in Figure 12. The intent of these wells is to determine the ground-water flow direction and the chemical analysis of any ground-water contamination. Based on Stage 1 analytical results an additional four (4) wells may be installed to determine the extent of contamination. The A-E shall make recommendations on the necessity and possible locations for additional monitoring wells in the Stage I Technical Report.

(c) Soil Sampling. Soil samples will be taken from the monitoring well samples taken according to paragraph 2.d.(1). Samples shall be analyzed by Organic Vapor Analyzer (OVA) and retained for chemical analyses. The three highest OVA sample readings in each well shall be analyzed in the laboratory for the chemical parameters in Table 7B. The A-E shall propose his method for field screening in the Drilling and Sampling Plan. One boring shall be placed near the sewer line southeast of Building 284 (see Figure 12). Samples shall be taken every 2.5 feet to 10 feet and OVA readings recorded. Samples shall be logged and OVA readings recorded. No samples shall be retained for analysis. The boring shall be back-filled with cuttings and concrete or asphalt patched if necessary.

(d) Chemical Analysis. The ground-water samples and soil samples (Table 7A and 7B) shall be analyzed for the following:

1. VOA.
2. A/B/N Extractables.
3. TRPH.
4. Lead.


(a) The JP-4 Underground Waste Tank is located on the southeast side of the main taxi access close to the projected First Street intersection (Figure 1). This underground tank has been used in the past few years as contaminated JP-4 waste fuel storage. The base has some concerns that the waste fuel is leaking from the tank due to the level of waste fuel measured in the tank.

(b) Monitoring Wells. Three (3) monitoring wells (Stage 1) shall be installed in this area to determine ground-water flow direction and to confirm the presence and type of any contamination. One of these wells shall be located upgradient of the tank. Three (3) additional wells may be installed (Stage 2) based on the analytical results of Stage 1 to define the extent of a contamination. All wells at this site located in
the unpaved area around the tank will be 2-3 feet above the ground surface and the protective casings and posts shall be painted yellow. Some of the wells in Stage 2 may require flush mounting if required to be installed where pavement is located.

(c) **Soil Sampling.** Soil samples taken in the monitoring well boreholes at depths of 2.5 and 5 feet below ground surface, and at 2 feet below the approximate bottom of the tank, shall undergo chemical analyses.

(d) **Chemical Analysis.** The ground-water samples and soil samples outlined in Table 8A and 8B shall be analyzed for the following:

1. VOA.
2. A/B/N Extractables.
3. TRPH.
4. Lead.

(7) **Site 54 - POL Washrack Discharge Area.**

(a) The POL washrack area is located south of Buildings 702 and 704 and consists of a washdown area, oil/water separator and discharge water line to the southwest of the POL area over into a trench approximately 100 feet from the west fence line. Pieces of this clay pipeline have been seen on the surface in this field area and it is presumed broken up. The concern over the discharge developed when the separator was improperly working and discharging high concentrations of petroleum product directly into the discharge area.

(b) **Monitoring Wells.** Three (3) monitoring wells (Stage 1) shall be located in this area to determine the ground-water flow direction and the presence of any fuel contamination in this area from an oil/water separator. An additional well shall be located in the area shown in Figure 14. Exact locations shall be based on information from base personnel. This well is to investigate possible spills in this area. Four (4) additional wells may be installed (Stage 2) based on the analytical results of Stage 1 to determine the extent of a contamination.

(c) **Soil Samples.** Soil samples shall be taken from all the monitoring well borings at depths of 2.5, 5, and 10 feet below the ground surface for chemical analysis. These samples shall undergo chemical analysis. Two soil borings shall be placed in the area shown in Figure 14. Samples shall be taken every 2.5 feet to 15 feet. All samples shall be screened in the field and the three (3) samples with the highest OVA readings per boring shall be retained for chemical analysis. Field screening methods shall be described in the Drilling and Sampling Plan.

(d) **Sediment Sampling.** Four (4) sediment samples shall be taken in the area of the drainage swale located approximately 100 feet from the washrack area running parallel to the fence. These samples shall undergo chemical analysis. The A-E shall propose methods and procedures for obtaining these samples.
(e) Chemical Analysis. The ground-water samples, soil samples, and sediment samples outlined in Table 9 shall be analyzed for the following:

1. VOA.
2. A/B/N Extractables.
3. TRPH.

(8) Site 55 - Military Gas Station.

(a) The Military Gas Station (Building 137) is located in the northeast section of the Main Base area on Fifth Street. This site was also a requested additional site for remedial investigation based on the possibility of a leaking underground tank.

(b) Monitoring Wells. Three (3) monitoring wells shall be located in the area of the underground tank at this site. These wells shall aid in confirming the presence of any contaminant plume in the area. An additional three (3) monitoring wells may be required in Stage 2 if necessary. The A-E shall recommend in the Stage 1 Technical Report Stage 2 well locations, and they will be approved by USACE prior to installation.

(c) Soil Sampling. Soil samples shall be obtained from the monitoring well borings at 2.5, 5, and 2 feet below the approximate bottom of the tank for chemical analysis.

(d) Chemical Analysis. The ground-water samples and soil samples (Table 10) shall be analyzed as listed below.

1. VOA.
2. TRPH.
3. Lead.

3. Special Considerations. All materials gathered and developed in the performance of this work listed in this contract shall be the property of the Corps of Engineers/U.S. Air Force and shall not be used or distributed by the A-E without specific written permission from the Corps of Engineers/U.S. Air Force.

4. Project Management.

a. Project Engineer. The Architect-Engineer shall assign a member or employee who will be known as the Project Engineer or Project Manager. This individual will oversee the correlation of the entire project, administer all instructions from this office, and answer or obtain answers to all questions from this office during and after the work.

b. Coordination. During the execution of the work under the contract, the A-E shall keep in close liaison with the Corps of Engineers Project Manager (USACE PM), who will coordinate the work with the Base
Environmental Coordinator and HQ TAC. All requests made by Base personnel shall be referred to the USACE Project Manager. Approval of all changes in the scope of services shall be given through the USACE-PM prior to their implementation.

5. **Base Support.** The A-E shall coordinate all requests for Base support services through the Base Environmental Coordinator. To avoid conflicts and schedule delays, (on the part of both parties) the A-E shall request all Base support services well in advance of their anticipated time of need (at least 14 days minimum). Likewise, it is anticipated that the Base will provide the following information and support to the A-E in a timely fashion upon request:

   a. **Existing Plans.** The Base shall provide the A-E with existing engineering plans, drawings, diagrams, and other information deemed necessary to evaluate the sites being investigated upon request. Existing aerial photographs will be supplied to A-E for use on this project by the COE-PM.

   b. **Security.** The Base shall provide vehicle passes and/or entry permits for all A-E personnel during the field work duration.

   c. **Equipment Storage.** The Base shall provide an area for the A-E and their subcontractors to store the equipment and supplies. A section of storage area must be protected from the weather elements and be accessible for a 7-day work schedule.

   d. **Temporary Office.** The A-E shall provide a temporary office area, which will be equipped with a telephone for local and long distance calls and an electrical power supply. The Base shall provide an area where the A-E can park a temporary trailer to be used as an office. Such space shall be located near a telephone pole and power supply line to which temporary lines can be established. The A-E will pay for all hookup fees and monthly charges.

   e. **Refrigerator/Freezer.** The A-E shall provide a household-type refrigerator having approximately two cubic feet of freezer space, which will be used daily for freezing blue-ice bags prior to sample shipments.

   f. **Well Locks.** The Base shall provide the A-E with one set of keys for all existing monitoring well locks. The A-E shall return the keys when the project field work is completed and provide locks and keys for all new monitoring wells. All existing and new monitoring wells shall be keyed alike.

6. **Travel and Meetings.** The A-E will perform the following required travel as part of the contract, and the cost thereof shall be included with the contract cost. Responsible representatives of the A-E's firm from the appropriate disciplines shall attend meetings and/or make the following listed trips:

   a. **Meetings.** Attendance by the A-E will be required at the ten (10) meetings noted below for the reasons stated.

      (1) **Scope Clarification Meeting.**
(a) **Purpose.** The purpose of this formal meeting will be to discuss this Scope of Services to insure a complete understanding of its intent and expected results with the A-E/Base/USACE.

(b) **Location.** The meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) **Attendees.** Expected attendees are HQ TAC-PM, Base Environmental Coordinator, A-E Project Manager, A-E Project Engineer, A-E Project Hydrogeologist, USACE-PM, Base Environmental Specialist, Base Environmental Engineer, and USACE Technical Staff.

(2) **Pre-Mobilization Coordination Meeting.**

(a) **Purpose.** The purpose of this informal meeting will be to discuss Section 5 of this Scope of Services with the Base and A-E. This meeting shall be held approximately two (2) weeks prior to any field mobilization efforts. The A-E shall come prepared to discuss any assistance deemed necessary to successfully mobilize the field team. The A-E will provide names, Social Security numbers, driver's license numbers, and vehicle numbers for all persons and equipment to be used during field activities. The A-E shall be responsible for coordinating the time of this meeting with appropriate Base personnel and the USACE-PM.

(b) **Location.** This meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) **Attendees.** Expected attendees are the A-E Project Engineer, A-E Field Team Leader, Base Environmental Coordinator, Base Environmental Specialist, Base Environmental Engineer, Base Public Affairs Representative, Base JAG, and USACE-PM.

(3) **Field Work Progress Meeting – Stage 1.**

(a) **Purpose.** The purpose of this informal meeting will be to allow both the Base and the A-E to air any concerns, conflicts or problems regarding the field work which is on-going. This meeting shall be held within one (1) week of the start of field investigations. The A-E shall be responsible for coordinating the time of this meeting with appropriate Base personnel and the USACE-PM.

(b) **Location.** This meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) **Attendees.** Expected attendees are the A-E Field Team Leader, Base Environmental Coordinator, Base Environmental Specialist, Base Environmental Engineer, and the USACE-PM.

(4) **Demobilization Meeting – Stage 1.**

(a) **Purpose.** The purpose of this informal meeting will be to ensure that the A-E and site investigation team leave the Base in an orderly state. This meeting shall be held not later than one (1) week prior to the A-E's demobilization from the Base. The A-E shall be respon-
sible for coordinating the time of this meeting with appropriate Base personnel and the USACE-PM.

(b) **Location.** This meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) **Attendees.** Expected attendees are the A-E Project Engineer, A-E Project Field Team Leader, Base Environmental Coordinator, Base Environmental Specialist and the USACE-PM.

(5) **Field Activities Stage 1 - Drilling and Sampling Technical Report Meetings.**

(a) **Purpose.** The purpose of this internal meeting will be to summarize the outcome of the Stage 1 field activities and to direct the A-E on the individual site Stage 2 field activity requirements. This informal meeting shall be held within 50 days after completion of Stage 1 sampling.

(b) **Location.** This meeting will be held at the A-E’s office, New Orleans, Louisiana.

(c) **Attendees.** Expected attendees are the A-E Project Manager, A-E Lab Manager, A-E Geologist, USACE Technical Staff, USACE Project Manager, and HQ TAC.

(6) **Field Work Progress Meeting - Stage 2.**

(a) **Purpose.** The purpose of this informal meeting will be to allow both the Base and the A-E to air any concerns, conflicts or problems regarding the field work which is on-going. This meeting shall be held within one (1) week of the start of field investigations. The A-E shall be responsible for coordinating the time of this meeting with appropriate Base personnel and the USACE-PM.

(b) **Location.** This meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) **Attendees.** Expected attendees are the A-E Field Team Leader, Base Environmental Coordinator, Base Environmental Specialist.

(7) **Demobilization Meeting - Stage 2.**

(a) **Purpose.** The purpose of this informal meeting will be to ensure that the A-E and site investigation team leave the Base in an orderly state. This meeting shall be held not later than one (1) week prior to the A-E’s demobilization from the Base. The A-E shall be responsible for coordinating the time of this meeting with appropriate Base personnel and the USACE-PM.

(b) **Location.** This meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) **Attendees.** Expected attendees are the A-E Project Engineer, A-E Project Field Team Leader, Base Environmental Coordinator,
Analytical Results Meeting.

(a) Purpose. The purpose of this meeting will be to allow the A-E to present and informally discuss the project analytical results with the COE analytical staff. This meeting shall be held within 60 days of the demobilization of the field work (or within 30 days of the A-E's receipt of the Government QA results). The A-E shall be prepared to discuss any technical difficulties encountered during sample analysis, any anomalies, false positives or other laboratory problems encountered during analysis with the COE analytical staff.

(b) Location. This meeting will be held at the A-E's office, New Orleans, Louisiana.

(c) Attendees. Expected attendees are the A-E Project Manager, A-E Lab Director, A-E Quality Assurance Staff, USACE Technical Staff, the USACE-PM, HQ TAC, Base Environmental Coordinator, and/or the Base Environmental Specialist, and/or the Base Environmental Engineer.


(a) Purpose. The purpose of this formal meeting will be to allow the A-E to present the results of the draft report, answer questions and incorporate appropriate comments and corrections into the final document. This meeting will be held within 80 days of the demobilization of the field work. The A-E shall be responsible for meeting coordination with the Base, Federal and Stage Regulatory Agencies, and the USACE-PM.

(b) Location. This meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) Attendees. Expected attendees are HQ TAC-PM, Base Environmental Coordinator, Base Commander, Base Civil Engineer, Base Environmental Specialist, Base Environmental Engineer, Federal and State Regulatory Agency Representatives, A-E Project Manager, A-E Project Engineer, A-E Project Geologist, USACE Project Manager and Technical Staff, and Air Force Regional Civil Engineer's (AFRCE) representative.

Remedial Investigation Final Report Meeting.

(a) Purpose. The purpose of this formal meeting will be to allow the A-E to present the Final Report and answer questions from the attendees. This meeting will be held within 14 days after submitting the Final Remedial Investigation Report. The A-E shall be responsible for coordinating with the same parties as described in Meeting (9) on this page.

(b) Location. This meeting will be held at Holloman AFB in the BCE Conference Room, Building 55.

(c) Attendees. Expected attendees are HQ TAC-PM, Base Environmental Coordinator, Base Commander, Base Civil Engineer, Base Environmental Specialist, Base Environmental Engineer, Federal and State
b. Travel. All travel required to obtain field data necessary to complete the Remedial Investigation Report as detailed herein.

c. Additional Trips. Additional trips required by the Contracting Officer to attend review conferences or other meetings, will be paid for at the site agreed upon in Article 2 of the Contract.

7. General.

a. Government Provided Data and Information.


(2) Installation Restoration Program, Phase II, Final Report for Holloman AFB, New Mexico.

(3) Installation Restoration Program, Phase II Stage 1, Final Report for BX Service Station, Holloman AFB, New Mexico.


(10) Sample Handling Protocol for Low, Medium and High Concentration Samples of Hazardous Waste, COE, October 1986.


b. Review of Progress and Technical Adequacy.

(1) At any appropriate times, representatives of the Contracting Officer may review the progress and technical adequacy of the A-E's work. Such review shall not relieve the A-E from performing all contract requirements, except as may be waived by written instruction.

(2) The A-E, under this contract, will interpose no objection or restriction to the Contracting Officer's designation of an A-E for the
purpose of reviewing the adequacy and corrections of the work performed under this contract.

(3) The A-E shall submit progress reports to the COE with each request for payment. The progress reports shall indicate work performed, costs, and problems incurred during the payment period.

c. Meeting Notes and Confirmation Notices.

(1) Meeting Notes. The A-E will be responsible for taking notes and preparing the reports of all conferences. Meeting notes will be prepared in typed form and the original furnished this office (within five (5) days after the date of the meeting) for concurrence and distribution to all attendees. This report shall include the following items as a minimum:

(a) The date and place the meeting was held with a list of attendees. The roster of attendees shall include name, organization, and telephone number.

(b) Written comments presented by attendees shall be attached to each report with the conference action noted. Meeting action shall be "A" for an Approved comment, "D" for a Disapproved comment, "W" for a comment that has been Withdrawn, and "E" for a comment that has an Exception noted.

(c) Comments made during the meeting, decisions affecting criteria changes, must be recorded in the basic meeting notes. Any augmentation of written comments should be documented by the meeting notes.

(2) Confirmation Notices. The A-E will be required to provide a record of all discussions, verbal directions, telephone conversations, etc., participated in by the A-E and/or his representatives on matters relative to this contract and the work. These records, entitled "Confirmation Notices," will be numbered sequentially and shall fully identify participating personnel, subject discussed, and any conclusions reached. The A-E shall forward to the Contracting Officer or his representative as soon as possible (not more than five (5) work days), a reproducible copy of said confirmation notices. Distribution of said confirmation notices will be made by the Government.

d. Expert Testimony. All technical consultants required for this investigation will be provided by the A-E and will be qualified to provide expert witness testimony, if required. In the event of litigation, the contract will be modified to compensate the A-E for the additional services required.

8. Reports. The A-E shall develop the following listed reports.

a. A-E Daily Quality Control Reports (A-E DQCR). During the field investigation activities, the A-E will provide Daily Quality Control Reports (DQCR) to the Contracting Officer, which will include the information found in "A-E Guidance for Developing A-E Quality Management Procedures for Site Investigative Activities." These reports should be compiled and sent to the Project Manager priority mail, every week. However, should problems arise, the A-E should notify the Project Manager.
immediately. A daily report shall be handcarried to the BCE office to the attention of the BEC.

b. A-E Quality Control Summary Report (A-E QCSR). A report submitted by the A-E at the conclusion of the site investigations outlining QC practices employed by the A-E including any problems and acceptable corrective actions taken, and containing a consolidation and summary of the A-E daily Quality Control Reports, as prescribed in the contract.

c. Pre-Draft Remedial Investigation (Analytical Data) Report. The A-E shall prepare a pre-draft report summarizing the analytical results of all the field investigation activities. A basic outline should be included for the remainder of the Remedial Investigation draft report. The pre-draft report will allow reviewers to draw conclusions with regard to the direction the draft report will be taking. This report shall be delivered two days prior to the Analytical Results Meeting to the USACE-PM.

d. Draft Remedial Investigation Report. The A-E shall prepare a draft report delineating all findings of the field investigations. The A-E shall adhere to the report format outlined in Chapter 9 of the "EPA - Guidance for Remedial Investigations Under CERCLA", dated June 1985. The A-E shall make every effort to ensure that the draft report is complete, in recommended format, and free of grammatical and typographical errors. This report shall include all work found in Site 17 - BX Service Station's Technical Report, which will have been completed earlier in the project.

e. Baseline Risk Assessment.

(1) General. A baseline risk assessment shall be prepared for each site after reviewing all available information. The danger each site poses to the public and environment shall be established. The assessment may be developed using the structure and methodologies outlined in the given guidance references or developed independently. As a minimum, the following four sections shall be addressed:

(a) Identification of contaminants with a summary of the selection bases for indicator chemicals.

(b) Estimation of exposure point concentrations based on sample results or simple analytical modeling.

(c) Preparation of toxicological profiles for indicator chemicals and identification of all applicable, relevant, and appropriate Federal and State Regulations (ARARs).

(d) Risk characterization for the composite non-carcinogenic and carcinogenic risk of exposure to multiple carcinogens.

(2) Examples of Guidance.


(k) U.S. EPA. Vertical and Horizontal Spread (VHS) Model, as adapted from Domenico and Palciauskas (1982), 50 FR 7896, 50 FR 48886, and 50 FR 50789.


f. Record of Decision and Decision Documents. During the submission of the final Remedial Investigation report, the A-E will prepare a Record of Decision (for all sites where no further action is required) or a Decision Document (for all sites where additional action is required). These shall be prepared for each site investigated under this contract. Each Record of Decision or Decision Document will be approximately two or three pages in length and shall be submitted to the Contracting Officer and
The intent of those documents will be to make a site specific statement in regard to future actions required at each site. The A-E will use the information developed during the RI process and contained in the Baseline Risk Assessment to substantiate and justify the conclusions presented in the Record of Decision/Decision Documents.

g. Final Remedial Investigation Report. The A-E shall incorporate all approved comments and suggestions generated during the draft review process into a final document. This document should be error free.

9. Submittals. A submittal register will be furnished by the Corps' Project Manager; however, the appropriate submittals will be as outlined at the end of these instructions.

a. General Submittal Requirements.

(1) Distribution. See the Document Submittal List for distribution of documents. In general, the A-E is responsible for reproduction and distribution of all documents. Documents shall be mailed to all reviewers via a carrier service that will provide overnight service, such as Express Mail, unless otherwise noted. A Document Submittal List which contains the reviewer's names and addresses will be furnished by the Project Manager.

(2) Partial Submittals. Partial submittals will not be accepted unless prior approval is given.

(3) Cover Letters. A cover letter should accompany each document and indicate the project, project phase, the date comments are due, to whom comments are to be submitted, the date and location of the review conference, etc., as appropriate. (Note that, depending on the recipient, not all letters will contain the same information.) The contents of the cover letters should be coordinated with the COE Project Manager prior to the submittal date. The cover letter shall not be bound into the document.

(4) Supporting Data and Calculations. The tabulation of criteria, data, circulations, cost estimates, and etc., which are performed but not included in detail in the report shall be assembled as appendices. Criteria information provided by the Omaha District need not be reiterated, although it should be referenced as appropriate. Persons performing and checking calculations are required to put their full names on the first sheet of all supporting calculations, estimates, and etc., and initial the following sheets. These may not be the same individual. Each sheet should be dated. A copy of the Final Scope of Services shall be included as Appendix A in the report.

(5) Reproducibles. One camera-ready, unbound copy of each submittal shall be provided to the COE and to HQ TAC. While all submittals should be error-free, an extra effort shall be made to provide an error-free Final Report.

b. Specific Submittal Requirements.

(1) A-E-Quality Control Plan and Sampling Plan. Three (3) addresses, seven (7) copies, including one (1) unbound, camera-ready copy
to the USACE Project Manager.

(2) A-E Safety, Health and Emergency Response Plan. Two (2) addresses, five (5) copies, including one (1) unbound, camera-ready copy to the USACE Project Manager.

(3) A-E Daily Quality Control Reports. One (1) address, one (1) copy to the USACE Project Manager, one (1) copy delivered to the BCE office daily.

(4) A-E Quality Control Summary Report. One (1) address, three (3) copies, including one (1) unbound, camera-ready copy to the USACE Project Manager.

(5) Pore Vapor Analysis and Plume Thickness Report. One (1) address, three (3) copies to USACE PM.

(6) Draft Site 17 - BX Service Station Technical Report. Three (3) addresses, seven (7) copies, including one (1) unbound, camera-ready copy to USACE Project Manager.

(7) Final Site 17 - BX Service Station Technical Report. Three (3) addresses, ten (10) copies, including one (1) unbound, camera-ready copy to both USACE PM and Holloman AFB.

(8) Pre-Draft Remedial Investigation Report (Analytical Results). One (1) address, three (3) copies to the USACE Project Manager, including one (1) unbound camera-ready copy delivered to the USACE-PM at the Analytical Meeting.

(9) Draft Remedial Investigation Report. Ten (10) addresses, twenty five (25) copies, including one (1) unbound, camera-ready copy to both HQ TAC and the USACE Project Manager.

(10) Baseline Risk Assessment. Two (2) addresses, four (4) copies, two (2) copies to HQ TAC and two (2) copies to the USACE Project Manager.

(11) Record of Decision and Decision Documents. Two (2) addresses, two (2) copies, one to HQ TAC and one to the USACE Project Manager.

(12) Final Remedial Investigation Report. Fifteen (15) addresses, fifty (50) copies, including one (1) unbound, camera-ready copy to both HQ TAC and the USACE Project Manager.

(13) Schedule. The A-E shall include with his proposal a schedule for the completion of all work as outlined in this Scope of Services.
2"x5' STEEL POST (3)

- STEEL PROTECTIVE CASING w/ HINGED CAP AND LOCK
- VENTED CAP
- 2" I.D. PVC PIPE w/ FLUSH THREADED JOINTS AS REQUIRED
- GROUND SURFACE
- 3'x3'x4" CONCRETE PAD
- CEMENT GROUT
- FLUSH THREADED JOINT
- FINE SILICA SAND
- FLUSH THREADED JOINT
- 2" I.D. PVC PRESLOTTED WELL SCREEN
- FILTER PACK
- FLUSH THREADED PLUG
- 6½" MIN.

Figure 2
Figure 5.
Holloman AFB, Service Station
Boring and Well Location Map

Legend
- Test Hole
- Monitor Well
- El Paso Laboratory Monitor Well
- TH-1° Plugged Test Hole

Figure 6.
Pump Test Cell #1
Well Location Map
(SEE FIGURE 2 FOR BASE LOCATION)
Pump Test Cell #2
Well Location Map

(SEE FIGURE 2 FOR BASE LOCATION)
### SUMMARY OF WATER LEVELS AND GASOLINE THICKNESSES

<table>
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<th>BORING/WELL NUMBER</th>
<th>DATE MEASUREMENT</th>
<th>ELEVATION OF WATER TABLE (feet, msl)</th>
<th>DEPTH TO WATER TABLE (feet)</th>
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*Trace is defined as strong gasoline odor with no measurable gasoline film.

Denotes value less than the limit of detection.

Away from contaminated area.

---

**Figure 9.**
Plume Configuration Change From Feb. 1981 to Sept. 1984

Gasoline Plume Contour Map (September, 1984)
EXPLANATION:
- BORING LOCATION AND NUMBER
- MONITORING WELL LOCATION AND NUMBER

DRAWING REFERENCE:
TITLED: SURVEY PLAT
BY: BURKE/COLLINS/ASSOCIATES PC ENGINEERS-SURVEYORS ALAMOGORDO, NEW MEXICO
DRAWING NO.: 6-4372
DATE: 10-19-84

SITES 18 AND 31

Figure 10

Figure 11
SITE 51

OIL SEPARATOR

BUILDING 296

SITES 51

EXPLANATION:
- BORING LOCATION AND NUMBER
- MONITORING WELL LOCATION AND NUMBER

DRAWING REFERENCE:
TITLED: SURVEY PLAT
BY: BURKE/COLLINS/ASSOCIATES PC ENGINEERS-SURVEYORS ALAMOGORDO, NEW MEXICO
DRAWING NO.: 8172
DATE: 10-18-84

Scale in Feet

0 50 100

Figure 13.
### TABLE 1. SUMMARY OF MONITORING WELL REQUIREMENTS

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<td>-</td>
<td>25</td>
<td>75 (75)</td>
</tr>
<tr>
<td>54</td>
<td>4 (4)</td>
<td>-</td>
<td>40</td>
<td>160 (160)</td>
</tr>
<tr>
<td>55</td>
<td>3 (3)</td>
<td>-</td>
<td>25</td>
<td>75 (75)</td>
</tr>
<tr>
<td>17</td>
<td>3 (3)</td>
<td>18**</td>
<td>25</td>
<td>75 (75)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>1145 (960)</strong></td>
</tr>
</tbody>
</table>

* NUMBERS IN PARENTHESES REPRESENT NUMBERS OF ADDITIONAL WELLS AND FOOTAGE FOR THE SECOND STAGE OF THE FIELD WORK.

** INCLUDING RECOVERY WELLS
TABLE 2. GROUNDWATER SAMPLING SPECIFICATIONS.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONTAINER*</th>
<th>SAMPLE PRESERVATION</th>
<th>HOLDING TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLATILE ORGANICS</td>
<td>TWO 40 ML GLASS VOA VIALS NO HEADS</td>
<td>ICE TO 4 C STORE INVERTED</td>
<td>14 DAYS</td>
</tr>
<tr>
<td>TOTAL RECOVERABLE PETROLEUM HYDROCARBONS</td>
<td>1-LITER AMBER GLASS BOTTLE 3/4 FULL</td>
<td>1:1 HCL TO pH &lt; 2 ICE TO 4 C</td>
<td>28 DAYS</td>
</tr>
<tr>
<td>ACID/BASE/NEUTRAL EXTRACTABLES</td>
<td>TWO 1-LITER AMBER GLASS BOTTLES</td>
<td>ICE TO 4 C</td>
<td>EXTRACT IN 7 DAYS ANALYZE IN 40 DAYS</td>
</tr>
<tr>
<td>TOTAL RECOVERABLE METALS</td>
<td>1-LITER HIGH DENSITY POLYETHYLENE BOTTLE</td>
<td>1:1 HNO3 TO pH &lt; 2 ICE TO 4 C</td>
<td>13 DAYS Hg OTHERS 6 MOS.</td>
</tr>
<tr>
<td>COMMON ANIONS</td>
<td>1-LITER GLASS JAR</td>
<td>ICE TO 4 C</td>
<td>14 DAYS</td>
</tr>
<tr>
<td>TOTAL DISSOLVED SOLIDS</td>
<td>1-LITER GLASS JAR</td>
<td>ICE TO 4 C</td>
<td>7 DAYS</td>
</tr>
</tbody>
</table>

* ALL CONTAINERS MUST HAVE TEFLO-LINED LIDS
### TABLE 3. SOIL AND SEDIMENT SAMPLING SPECIFICATIONS.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONTAINER*</th>
<th>SAMPLE PRESERVATION</th>
<th>HOLDING TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLATILE ORGANICS</td>
<td>TWO 40 mL GLASS VOA VIALS, NO HEADSPACE</td>
<td>ICE</td>
<td>ANALYZE IN 14 DAYS</td>
</tr>
<tr>
<td>TOTAL RECOVERABLE PETROLEUM HYDROCARBONS</td>
<td>1-8oz GLASS WIDE-MOUTH BOTTLE 3/4 FULL</td>
<td>ICE</td>
<td>EXTRACT IN 14 DAYS</td>
</tr>
<tr>
<td>ACID/BASE/ NEUTRAL EXTRACTABLES</td>
<td>1-8oz AMBER GLASS BOTTLE 3/4 FULL</td>
<td>ICE</td>
<td>EXTRACT IN 7 DAYS</td>
</tr>
<tr>
<td>TOTAL METALS</td>
<td>1-8oz GLASS WIDE-MOUTH BOTTLE 4 C</td>
<td>ICE</td>
<td>38 DAYS FOR Hg</td>
</tr>
</tbody>
</table>

*ALL CONTAINERS MUST HAVE TEFLON-LINED LIDS*
### Table 4. Projected Sampling Breakdown for Site 1, Main Base Landfill.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality Control Samples</th>
<th>Quality Assurance Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Field Samples</td>
<td>No. of Field Dupl.</td>
</tr>
<tr>
<td>Groundwater Samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatile Organics</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>TR Petroleum Hydrocarbons</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>A/B/N Extractables</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Total Recoverable Metals</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Common Anions</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Dissolved Solids</td>
<td>12</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Numbers above reflect the total of two field efforts.
TABLE 5A. PROJECTED SAMPLING BREAKDOWN FOR SITE 31, FD TA.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>QUALITY CONTROL SAMPLES</th>
<th>QUALITY ASSURANCE SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF FIELD DUPL.</td>
</tr>
<tr>
<td>GROUNDWATER SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>BASE/NEUTRAL EXTRACTABLES</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>TRPH</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>LEAD</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE: SAMPLES ABOVE REFLECT TWO FIELD EFFORTS.
TABLE 5B. PROJECTED SAMPLING BREAKDOWN FOR SITE 31, FDITA.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>QUALITY CONTROL SAMPLES</th>
<th>QUALITY ASSURANCE SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF FIELD DUPL.</td>
</tr>
<tr>
<td>SOIL AND SEDIMENT SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>BASE/NEUTRAL EXTRACTABLES</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>TRPH</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>LEAD</td>
<td>16</td>
<td>3</td>
</tr>
</tbody>
</table>

NOTE: SAMPLES ABOVE REFLECT TWO FIELD EFFORTS. ALSO, QC/QA SAMPLES MUST BE TAKEN FOR SOIL AND SEDIMENT.
### Table 6. Projected Sampling Breakdown for Site 50, Aircraft Maintenance Hangar.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality Control Samples</th>
<th>Quality Assurance Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF FIELD DUPL.</td>
</tr>
<tr>
<td>Roundwater Samples*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatile Organics</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>A/B/N Extractables</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>TRPH</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Oil Samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatile Organics</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>A/B/N Extractables</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>TRPH</td>
<td>24</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Samples above reflect two field efforts. * Groundwater samples include one (1) for possible floating product.
TABLE 7A. PROJECTED SAMPLING BREAKDOWN FOR SITE 51, OLD AGE REFUELING STATION.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>QUALITY CONTROL SAMPLES</th>
<th>QUALITY ASSURANCE SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF FIELD DUPL.</td>
</tr>
<tr>
<td>ROUNDWATER SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>A/B/N EXTRACTABLES</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>TRPH</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>LEAD</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE: SAMPLES ABOVE REFLECT TWO FIELD EFFORTS. ALSO, SAMPLE NUMBER INCLUDES ONE (1) FOR POSSIBLE FLOATING PRODUCT.
TABLE 7B. PROJECTED SAMPLING BREAKDOWN FOR SITE 51, OLD AGE REFUELING STATION.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>QUALITY CONTROL SAMPLES</th>
<th>QUALITY ASSURANCE SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF FIELD DUPL.</td>
</tr>
<tr>
<td>SOIL SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>27</td>
<td>3</td>
</tr>
<tr>
<td>A/B/N EXTRACTABLES</td>
<td>27</td>
<td>3</td>
</tr>
<tr>
<td>TRPH</td>
<td>27</td>
<td>3</td>
</tr>
<tr>
<td>LEAD</td>
<td>27</td>
<td>3</td>
</tr>
</tbody>
</table>

NOTE: SAMPLES ABOVE REFLECT TWO FIELD EFFORTS.
**Table 8a. Projected Sampling Breakdown for Site 53, JP-4 Underground Waste Tank.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality Control Samples</th>
<th>Quality Assurance Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Field Samples</td>
<td>No. of Field DUPL.</td>
</tr>
<tr>
<td>Roundwater Samples</td>
<td>7 2 2 2 13 2 2 2 6</td>
<td></td>
</tr>
<tr>
<td>Volatile Organics</td>
<td>7 2 2 11 2 2 4</td>
<td></td>
</tr>
<tr>
<td>A/B/N Extractables</td>
<td>7 2 2 11 2 2 4</td>
<td></td>
</tr>
<tr>
<td>TRPH</td>
<td>7 2 2 11 2 2 4</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>7 2 2 11 2 2 4</td>
<td></td>
</tr>
</tbody>
</table>

*Note:* Samples above reflect two field efforts. Also, sample number includes one (1) for possible floating product.
### TABLE 88. PROJECTED SAMPLING BREAKDOWN FOR SITE 53, JP-4 UNDERGROUND WASTE TANK.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>QUALITY CONTROL SAMPLES</th>
<th>QUALITY ASSURANCE SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF FIELD SAMPLER DUPL.</td>
</tr>
<tr>
<td>OIL SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>A/B/N EXTRACTABLES</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>TRPH</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>LEAD</td>
<td>18</td>
<td>2</td>
</tr>
</tbody>
</table>

**Note:** SAMPLES ABOVE REFLECT TWO FIELD EFFORTS.
TABLE 9. PROJECTED SAMPLING BREAKDOWN FOR SITE 54, POL WASHRACK DISCHARGE AREA.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>QUALITY CONTROL SAMPLES</th>
<th>QUALITY ASSURANCE SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF DUPL.</td>
</tr>
<tr>
<td>ROUNDWATER SAMPLES*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>A/B/N EXTRACTABLES</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>TRPH</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>OIL AND SEDIMENT SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>34(4)</td>
<td>7(2)</td>
</tr>
<tr>
<td>A/B/N EXTRACTABLES</td>
<td>34(4)</td>
<td>7(2)</td>
</tr>
<tr>
<td>TRPH</td>
<td>34(4)</td>
<td>7(2)</td>
</tr>
</tbody>
</table>

NOTE: SAMPLES ABOVE REFLECT TWO FIELD EFFORTS. * GROUNDWATER SAMPLES INCLUDE ONE (1) FOR POSSIBLE FLOATING PRODUCT. NUMBERS IN PARENTHESES REPRESENT SEDIMENT SAMPLES.
TABLE 10. PROJECTED SAMPLING BREAKDOWN FOR SITE 55, MILITARY GAS STATION.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>QUALITY CONTROL SAMPLES</th>
<th>QUALITY ASSURANCE SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF FIELD SAMPLES</td>
<td>NO. OF FIELD DUPL.</td>
</tr>
<tr>
<td>ROUNDWATER SAMPLES*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>TRPH</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>LEAD</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>OIL SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLATILE ORGANICS</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>TRPH</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>LEAD</td>
<td>18</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE: SAMPLES ABOVE REFLECT TWO FIELD EFFORTS. * GROUNDWATER SAMPLES INCLUDE ONE (1) FOR POSSIBLE FLOATING PRODUCT.