US Army
Environmental Center

FINAL

FORT WINGATE DEPOT ACTIVITY
RESOURCE CONSERVATION AND RECOVERY ACT
Interim Status Closure Plan

Submitted to:

State of New Mexico
Environment Department
Santa Fe, New Mexico

Prepared for:

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND 21010

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RESPONSE TO STATE OF NEW MEXICO - ENVIRONMENT DEPARTMENT
NOTICE OF DEFICIENCY COMMENTS
FOR
FORT WINGATE DEPOT ACTIVITY
INTERIM STATUS CLOSURE PLAN
18 DECEMBER 1992

Comment 1. Section 1.3; DESCRIPTION OF THE FACILITY; Page 1-5; second paragraph.

The closure plan needs to provide a more complete description of the potential of the OD/OD area for flooding. The description should relate to the potential for hazardous waste and hazardous constituents to migrate from the units during flood events. The closure plan should explain whether the sampling strategy will be adjusted based on an analysis of the potential for past flood events to cause migration from the units. If the analysis indicates that flooding may have caused migration, then the sampling strategy section of the closure plan should reflect any additional sampling necessary. Fort Wingate needs to provide a flood-plain map in the closure plan which describes the 100-year flood-plain.

Response:
The Closure Plan has been revised to include additional description of the topographical location of the Open Burning and Demolition Area (OBDA). An aerial photograph and a scaled drawing of the OBDA have also been included as Figures 1-3 and 1-4, respectively. The main potential pathway for surface water run-off and the resulting potential contaminant migration is to the arroyo which is located within and runs from south to north through the OBDA. The proposed field screening program includes the collection of sediment samples from the arroyo.

Reference has also been included in Subsection 1.3 of the Closure Plan to the RCRA Part B Permit Application previously submitted (November 1988) for the Open Burning/Open Detonation (OB/OD) operations which stated that the OB/OD facilities were not located within the 100-year flood plain of the South Fork of the Puerco River. In addition, an examination of the topographical map of the FWDA shows that the elevation of the Puerco River is below 6,800 feet, while the OBDA is above 7,100 feet.

Comment 2. Section 1.3; DESCRIPTION OF THE FACILITY; Open Detonation of High Explosives; Page 1-6; first paragraph.

This paragraph indicates that "approximately" eleven (11) demolition areas or craters currently exist within the OB/OD area. The closure plan needs to describe the exact number and location of all demolition areas or craters which are to be included in the activities covered by this closure plan. The closure plan must include all demolition areas or craters that were in operation or for which construction commenced on or before November 19, 1980. Demolition areas or craters that ceased operation before the above date are not subject to interim status closure requirements and do not have to be included in this closure plan.

However, please note that Fort Wingate has the option of including all OB/OD demolition areas or craters in the closure plan regardless of the dates of each unit's period of operation. If Fort Wingate exercises this option, then interim status closure requirements will apply to all units identified in the closure plan regardless of their date of operation. This option is expected to be the most practical approach in addressing all potential contamination sources in the OB/OD area under one set of regulatory requirements, particularly if records can not conclusively differentiate between solid waste management units and interim status units.

A more detailed scale map of the OB/OD area needs to be provided in the closure plan. This should include dimensions of each demolition area or crater as well as the dimensions of the burning area. Proposed soil sampling locations should be included on this or a similar map.

Response:
An aerial photograph (dated 1985) and a scaled drawing of the OBDA have been included in the Final Closure Plan as Figures 1-3 and 1-4, respectively. The aerial photograph (Figure 1-3) is a depiction of the area (and the number of craters) at the time the aerial photography was performed (1985). The scaled drawing of the OBDA has been generated based upon the aerial photograph and updated based on recent (January 1993) visual field verification.

Subsection 1.3 of the Closure Plan has been revised to state that ten (10) demolition areas or craters are currently visible within the OBDA. These craters have all been shown on Figure 1-3. As stated in Subsection 1.3, the demolition areas or craters are similarly constructed, consisting of a graded central area surrounded on three sides by continuous bermed walls, typicaly 10-15 feet in height. In addition, the dimensions of the existing Burning Ground Area are approximately 350 ft x 75 ft. The proposed field screening sampling locations are shown in Figure 3-1 and discussed in Subsection 3.2 of the Closure Plan.

As discussed in Section 2 of the Closure Plan, the regulated units at the OBDA include the open burning and detonation facilities and at closure, the OB/OD facilities, consisting of the Burning Ground Area, the two (2) remaining burning trays, and all of the existing, visually identifiable demolition areas or craters will be included in the performance of closure. Further, the proposed field screening will be performed to identify areas of concern within the OBDA and to direct the more comprehensive sampling and analysis for closure confirmation.

Comment 3. Section 2.1; BASIS OF CLOSURE (40 CFR 265.111); Page 2-1; second paragraph.

This paragraph of the closure plan outlines the closure activities to be used to meet the closure performance standard. This section of the closure plan states that, "If soils are found to pose unreasonable risks to human health and the environment, these soils will be removed, stabilized, or controlled to reduce these risks to acceptable levels."

Fort Wingate must propose target concentrations in the closure plan for each hazardous constituent in each environmental media which will be used to determine the unreasonable risk posed to human health and the environment from potential contamination at the site as discussed in this section. These target concentrations should reflect NMED-Approved Health-Based Exposure Limit Criteria. These concentrations may be found in the proposed Federal Register notice published by the Environmental Protection Agency at 55 FR 30865 - 30873 (July 27, 1990) in Appendices A through F.

These concentrations are updated frequently, so Fort Wingate should contact the Health Assessment Section of the Characterization and Assessment Division of the Office of Solid Waste at EPA Headquarters at (202) 260-4761 or the Environmental Criteria and Assessment Office at (513) 569-7595 for the most current health-based concentration data. If no health-based exposure concentrations are available for a hazardous constituent, then toxicity data may be submitted of sufficient quality for the NMED to determine the environmental and human health effects. The health-based concentrations should be applied according to the clean closure criteria found in 53 FR 8704 - 8709 (March 19, 1987).

Fort Wingate should add a section to the closure plan that discusses the details of the criteria for determining if constituents will pose an unreasonable risk to human health and the environments discussed above. This criteria will trigger the removal, stabilization, or other control necessary to reduce these risks to acceptable levels as outlined on Page 2-1 of the closure plan.

Response:
Action levels for soils have been developed on the basis of proposed Federal Register notice 55 FR 30865 - 30873, Appendices A through F, and are presented in Section 3 of the revised Closure Plan. Soil action levels were developed for all of the established closure parameters for which health-based reference doses on carcenogenic potency factors are available. The procedures used to select the closure parameters are described in the Response to Comment 9.

Comment 4. Section 2.1; BASIS OF CLOSURE (40 CFR 265.111); Page 2-1; fourth paragraph.

A requirement of clean closure is to demonstrate that the hazardous waste units did not and do not have the potential to impact ground water above NMED-Approved Health-Based Limit Criteria. NMED requires Fort Wingate to collect ground water monitoring data from wells installed to monitor the OB/OD area, or to provide soils data which may be used in lieu of ground water monitoring data, which demonstrates no impact on ground water underneath the units. Since Fort Wingate has not proposed a ground water investigation program to support clean closure, then a subsoils sampling program must be included in the closure plan.

In situations where ground water is located at significant depths from the surface, NMED may consider results from a representative subsoil sampling program to serve as proxy for ground water data. If Fort Wingate wishes to use soils data as a proxy for ground water monitoring data, then the HRMB offers the following recommendation for your consideration. Given the imprecise nature of contaminant transport in the subsurface, the HRMB requires that subsoil sampling confirm a certain depth of clean soil below a unit. This data is expected to provide reasonable assurance that preferential migration pathways, which could carry contaminants to ground water have not been missed in the sampling program. The subsoils data must show that at a given sampling location no hazardous constituents are identified in a sample either at the ten (10) feet depth below the surface or at a depth which is ten (10) feet deeper than the last sample collected which showed no concentrations of hazardous constituents, whichever is deeper. (i.e., at a minimum, the subsoils sampling program must show ten (10) feet of clean soil below the last detectable contamination) Samples should be collected approximately every three (3) feet in each ten (10) foot interval and samples should be analyzed according to the procedures of SW-846.

Response:
The suggestion to use representative subsurface soil sampling as a proxy for ground water monitoring data to demonstrate no impact to site ground water has been incorporated into the Final Closure Plan. Because ground water at the site is located at significant depths below land surface and has not likely been impacted by site activities, Subsection 3.4 of the Final Closure Plan has been revised to state that subsurface soil sampling will be conducted to determine the levels of hazardous constituents above the naturally occurring background levels within the selected sampling locations of a 10-foot thick unit of soil. Subsection 3.3 of the Final Closure Plan describes the specific closure procedures including the specific subsurface sampling intervals. Samples will be collected at two (2) foot intervals, to coincide with the four (4) foot interval required for down-hole UXO monitoring.

Further, as stated in Subsection 3.4 of the Final Closure Plan, the spring located in the OBDA will be sampled as part of the Base Closure - Environmental Investigation Program and the results compared to applicable standards to establish the need for further investigation.

In addition, Table 3-2 of the Final Closure Plan provides the USATHAMA and similar USEPA (SW-846) analytical methods to be used in the performance of closure,

Comment 5. Section 3.1; PRECLOSURE ACTIVITIES; UXO Survey; Page 3-1.

The closure plan must present all details of the UXO Survey planned for the OB/OD area. The HRMB's reason for requiring the details of the survey is that the regulations governing closure dictate that the closure plan must include a detailed description of the steps to remove or decontaminate all hazardous waste residues including, but not limited to procedures for removing contaminated soils and methods for sampling and testing surrounding soils and criteria for determining the extent of decontamination necessary to satisfy the closure performance standard. (See 40 CFR 265.112(b)(4). All residues originating from the OB/OD area are subject to clean closure criteria which is to assure that all hazardous waste residues are located and removed or decontaminated to NMED-Approved Health-Based Exposure Limit Criteria.

Response:
The Final Closure Plan has been revised to include details of the planned UXO survey activities to be performed in conjunction with the implementation of closure. Additionally, the "Work Plan for UXO Support Services at Fort Wingate, New Mexico, November 1992", revised January 1993, has been included as Appendix B to the Final Closure Plan.

Comment 6. Section 3.1; PRECLOSURE ACTIVITIES; Background Sampling; Page3-1.

The closure plan should specify the list of metals that are being selected for the determination of naturally occurring background.

Methodology for obtaining representative background concentrations should be more fully explained in this section of the closure plan. Due to the nature of how Fort Wingate has managed the demolition areas or craters by mixing the soils in the area, the background sampling should describe whether the background samples will be composite or discrete in each soil horizon chosen for sampling. How will the individual soil horizons be combined in order to be representative of the demolition area or crater soils which have been mixed? This section of the closure plan should also specify the background soil sampling depths. Total number of background soil samples to be collected should be provided.

Response:
Section 3 of the Final Closure Plan has been revised to describe the metals to be analyzed for and the procedures to be followed to determine background levels in soils. All metals contained in any of the materials historically treated at FWDA or included in the list of explosive hazardous constituents, for which analytical methods exist, were reviewed. This list was then refined by eliminating those metals typically considered ubiquitous in the environment and not generally classified as "hazardous", including sodium, potassium, phosphorus, and magnesium. The refined list of metals was then included in the list of closure parameters presented in Table 3-2.

Comment 7. Section 3.2; CLOSURE PARAMETERS AND ACTION LEVELS; Page 3-2; second paragraph to end of section.

This section should be deleted from the closure plan. Any hazardous constituents remaining in or around the OB/OD area, which result from operations in the area, above NMED-Approved Health-Based Exposure Limit Criteria will be subject to post closure permit requirements. See comment #3 above for establishing action levels. Future land use of the facility is not a consideration in assessing a demonstration of clean closure of an interim status unit.

Response:
The section describing the development of risk-based action levels has been deleted from the Final Closure Plan, and a revised section describing the establishment of action levels has been included as discussed in the Response to Comment No. 3.

Comment 8. Table 3-1

The Extraction Procedure (EP) has been replaced by the Toxicity Characteristic Leaching Procedure (TCLP) to determine the toxicity characteristic of hazardous waste. Please note that the TCLP is used to determine whether a solid waste is also a hazardous waste. The TCLP has limited applicability for determining clean closure concentrations for soils. Fort Wingate should change Table 3-1 to show that total metals analysis of soils will be conducted instead of the EP Toxicity analysis. This analysis will be compared to the NMED-Approved Health-Based Exposure Limit Criteria for these constituents in soils or to background concentrations for these constituents in soils to determine the need for removal or decontamination.

Table 3-1 should include the analytical method numbers proposed for each constituent in the table. Specify that methods are from the most recent edition of SE-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.

Response:
Table 3-1 has been revised to include the established closure parameters. In addition, the metals selected as closure parameters have been shown as, and will be analyzed for, total metals. Further, Table 3-1 has been revised to include the proposed USATHAMA (and similar USEPA "SW - 846") analytical method numbers and the proposed action levels for each constituent on the Table.

Comment 9. Section 3.3; SPECIFIC CLOSURE PROCEDURES; Page 3-2; first paragraph.

This section of the closure plan needs to provide more detail of Fort Wingate's rationale for selecting the constituents on Table 3-1 for closure sampling. Explain how sampling for the constituents listed on Table 3-1 will identify all explosive hazardous constituents as identified in Appendix III. See related comment in #17 below.

Response:
As discussed in Subsection 3.2 of the Final Closure Plan, the closure parameters listed on Table 3-2 (formerly Table 3-1) were selected by reviewing previous Army studies at OB/OD facilities, the lists of materials historically treated at FWDA and the explosive hazardous constituents, and the results of previous sampling programs at the OBDA and included all compounds for which an analytical method is available.

In addition, Target Compound List volatiles and semivolatiles were added to the list of closure parameters to cover the use of fuels and other compounds that may have been used to initiate burning at the Open Burning Area.

Comment 10. Section 3.3; SPECIFIC CLOSURE PROCEDURES; Page 3-3; first paragraph.

This section of the closure plan states that Fort Wingate will conduct additional sampling and analysis to determine the areal extent of the contamination or directed excavation will be implemented in the affected (i.e., hot spot) area, and the area(s) will be resampled for the constituents that previously exceeded closure criteria, until closure is confirmed.

NMED agrees with this approach. However, no details are given in the closure plan regarding how hot spots will be identified and how much excavation will be considered sufficient to ensure the contamination is removed to the health based concentrations. Also, the closure plan contains no details for conducting additional sampling to determine the areal extent of contamination and no details are given regarding the sampling that is necessary to confirm that excavation successfully removed all contamination above health based concentrations.

The closure plan may be approved by NMED for the initial phase of closure sampling, but provisions must be made in the closure plan for requesting a modification to the approved plan to provide the details of subsequent closure activities. Since Fort Wingate has provided the general closure approach to be implemented in this paragraph, the details of determining the areal extent of contamination, any excavation which may be necessary, and the confirmation sampling, may be submitted to the HRMB as a closure plan modification request after the initial sampling results are obtained. The closure plan should be revised either to provide all details of determining the areal extent of contamination, excavation, and confirmation sampling, or be revised to provide for a modification request after the first stage of closure sampling and analysis activities.

The HRMB recommends that Fort Wingate consider inserting the following paragraph after the first paragraph of this section, if the closure plan modification request option described above is chosen.

> Should the analytical results of the confirmatory soil samples show concentrations of the closure parameters that exceed the established action levels, Fort Wingate will submit a closure plan modification request to the HRMB which:
>
> describes the areas which potentially exceed the established action levels based on the preliminary sample results;
>
> describes the additional sampling and analysis necessary to determine the areal extent of contamination exceeding established action levels;
>
> describes the details of excavation activities necessary in the affected areas to remove soils that are found to contain contamination above established action levels; and
>
> provides sampling and analysis plan to confirm that excavation activities were successful in removing contamination above established action levels and that no hot spots remain above the established action levels.

The closure plan modification request will be submitted to the HRMB within 60 days of a determination that soils exceed established action levels based on the first closure sampling results.

Response:
The approach to closure has been modified to include field screening followed by the performance of confirmatory closure sampling. The procedures to be followed for the field screening are presented in Section 3.1 of the Final Closure Plan. The parameters selected for field screening include TNT, RDX and volatile organics. TNT and RDX will provide an indication of the potential areal impact from explosives detonation operations and are explosives that can be analyzed in the laboratory on a quick turn around basis. Screening for volatile organics will

be additionally performed in the Burning Ground Area as an indication of the impact of open burning activities.

The closure sampling procedures are outlined in Section 3 of the Final Closure Plan and the text has been revised to state that a closure plan modification request will be submitted to the NMED to fully define the proposed closure confirmation sampling once the results of the field screening are evaluated.

Comment 11. Section 3.3; SPECIFIC CLOSURE PROCEDURES; Page 3-3; last paragraph.

The closure plan must describe how "flashing" PEP wastes present in the burn pans will accomplish decontamination of the pans. The description presented in the closure plan appears to be more of a method to treat UXO rather than a method to decontaminate the burn pans. Fort Wingate may consider a plan for steam cleaning the burn pans and then conducting wipe or other samples to verify the success of decontamination process after the final PEP wastes are flashed.

This section of the closure plan also needs to describe how the "supporting metal structures" will be decontaminated.

Response:
The two (2) remaining burning pans in the Burning Ground Area may be decontaminated and removed from the OBDA prior to the initiation of closure or the details of closure included in the proposed closure modification request.

Comment 12. Section 3.4; SAMPLING AND ANALYSIS; DEMOLITION AREA; Page 3-4; first paragraph.

This paragraph should specify the <u>exact</u> number of demolition areas or craters covered by this closure plan.

second paragraph:

This section should specify the total number of samples to be collected for each demolition area or crater and specify which samples are proposed as discrete and which are proposed as composite.

third paragraph:

This section should specify the sampling locations on a scale map and the total number of samples to be taken. Specify if the samples are discrete or composite. A plan for collecting soil samples at the surface should be included in the closure plan, or provide the reasons that surface samples are not needed to describe potential contamination at the burning area.

Response:
The Final Closure Plan and specifically Section 3 has been revised to state that the number of identified demolition areas or craters has been quantified as ten (10).

second paragraph:

Section 3 of the Closure Plan has been revised and Table 3-1 has been included to describe the number of samples to be collected during the field screening program. In addition, Subsection 3.1 of the Closure Plan describes the proposed field screening program and Subsection 3.4 outlines the proposed closure sampling and analysis program.

third paragraph:

The proposed field screening sampling locations have been shown on Figure 3-1 and the number of proposed samples are summarized on Table 3-1. The closure sampling program will be finalized based on the results of the field screening program and detailed in the closure modification request as discussed in Subsection 3.3 of the Closure Plan.

Comment 13. Section 4.0; Closure Certification (40 CFR 265.120); Page 4-1; first paragraph.

Specify that the certifying engineer is an "independent registered professional engineer".

Add a statement to this section that NMED will be allowed to inspect the closed facility after closure certification is submitted.

last paragraph

Add the following information to this section:

FINAL REPORT

The final report, due 60 days after completion of all closure activities, will contain at a minimum, the following:

a. A QA/QC summary on the adequacy of the analyses and the decontamination demonstration.

b. A Construction Quality Assurance Summary on the closure activities.

c. A copy of the file of supporting documentation:

   1. Field log books,

   2. Laboratory sample analysis reports,

3. The QA/QC documentation, and

4. Chain-of-Custody records.

d. Disposal location of all hazardous waste and hazardous waste residues.

e. A narrative summary of all testing done during the closure activities.

f. The details of any variance from the approved closure plan and the reason for the variance.

g. The survey plat as specified in 40 CFR 265.16 (if necessary).

h. A certification of the accuracy of the report.

Response:
Section 4 of the Closure Plan has been revised as follows: the registered professional engineer has been clarified as "independent", a statement has been added that the NMED will be allowed to inspect the closed facility after closure certification is submitted, and the requested additions defining the contents of the final closure report have been incorporated.

Comment 14. Section 5.0; SCHEDULE OF ACTIVITIES; Page 5-1.

This section of the closure plan should either be deleted or updated to reflect the current schedule. The tentative schedule is for Fort Wingate to respond to these comments by the end of January 1993. The HRMB will review the response and publish public notice of the document around the first of March 1993. The public comment period will run for 30 days. The NMED will respond to any public comments received and reach a final decision on the closure plan around the end of April 1993. This schedule could be delayed if an inadequate response is received from Fort wingate, a request for a public hearing is received during the public comment period, or if substantial public comments are received.

Response:
Section 5 has been updated to reflect the revised 1 March 1993 submittal date of the Final Closure Plan and the anticipated period of required HRMB review, public notice and response. Table 5-1 has also been eliminated and Section 5 has been revised to note that a schedule for the specific closure operations will be established following final approval of the Closure Plan and prior to the actual initiation of closure.

Comment 15. Section 8.1; Page 8-1; third paragraph.

The sentence, "The Post-Closure Plan will encompass the following elements as required/applicable:" should be changed to, "The Post-Closure Plan will encompass applicable requirements of 40 CFR 265.117-265.120 and the following elements as required/applicable:".

Response:
The requested change in language to Subsection 8.1 of the Closure Plan has been made.

Comment 16. General Comment.

The draft closure plan received by the HRMB contains page 3-2, dated 11/4/92, immediately following page 8-1. The HRMB proposes that Fort Wingate remove page 3-2 dated 11/4/92 from the closure plan, because another page 3-2 dated 11/6/92 exists in numerical order elsewhere in the closure plan. This error should be corrected in the revised closure plan which is to be submitted in response to these comments.

Response:
The pagination error has been corrected in the Final Closure Plan.

Comment 17. Table C-3; Page C-16.

Antimony Sulfide is listed in Table C-3 {of Appendix A of the Closure Plan} as an explosive waste. Antimony is considered a systemic toxicant by NMED with an approved health based exposure limit of approximately 3 E+01 mg/kg in soils and 1 E-02 mg/dg in water. Fort Wingate should add antimony to Table 3-1 for closure sampling or explain the reasons for excluding antimony from the sampling program.

Response:
As previously discussed in the Responses to Comment Nos. 6 and 9, antimony as well as aluminum, bismuth, boron, nickel, and zinc have been added to the list of closure parameters provided on Table 3-2 (formerly Table 3-1) and discussed in Subsection 3.2 of the Closure Plan.

Response:
The [illegible] Section 8.1 [illegible] Plan [illegible]

Comment [illegible]

The draft [illegible] contains [illegible] [illegible] [illegible] should be [illegible] response to [illegible]

Response:
The [illegible] in the Final [illegible]

Comment [illegible]

[illegible] [illegible] [illegible] [illegible]

Response:
[illegible] [illegible] [illegible] Table [illegible] of the [illegible]

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"Work Plan for UXO Support Services at Fort Wingate, New Mexico, November 1992", Prepared By UXB International, Inc. Revised January 1993.

Appendix C

Excerpts from the "Master Environmental Plan, Fort Wingate Depot Activity, Gallup, New Mexico, December 1990, USATHAMA.

Appendix D

Toxicity Reference Information

Appendix E

Excerpts from the Sampling and Analysis Plan of the "Environmental Investigation (EI) Work Plans for Areas Requiring Environmental Evaluation at Fort Wingate Depot Activity (FWDA), November 1992

ACRONYMS AND ABBREVIATIONS

AOCs	Areas of Concern
CFR	Code of Federal Regulations
CSF	Carcinogenic Slope Factor
DNB	dinitrobenzene
DNT	dinitrotoluene
DRMO	Defense Reutilization and Marketing Office
EI	Environmental Investigation
EOD	Explosives Ordnance Demolition
ERM	Environmental Resources Management, Inc.
FWDA	Fort Wingate Depot Activity
HMX	cyclotetramethylenetetranitramine
HSP	Health & Safety Plan
HWMR	Hazardous Waste Management Regulations
MCL	maximum contaminant level
NA	Not Available
NB	nitrobenzene
NC	Not Calculated
NMED	New Mexico Environment Department
OBDA	Open Burning and Demolition Area
OB/OD	Open Burning/Open Detonation
OVA	Organic Vapor Analyzer
PEP	Propellants, Explosives, and Pyrotechnics
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RDX	Royal Demolition Explosive - hexohydro-1,3,5-trinitro-1,3,5-triazine
RfD	Reference Dose

SWMU	Solid Waste Management Unit
TCL	Target Compound List
TEAD	Tooele Army Depot
TNT	2,4,6-trinitrotoluene
USAEC	U. S. Army Environmental Center
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
5X	A condition of explosives removal, via open burning of explosives-contaminiated scrap metal, to where no trace of explosive remains after open burning. Scrap is then available to be sold for public salvage.

1.0 INTRODUCTION

1.1 PURPOSE

This plan details the activities to be performed for closure of the Resource Conservation and Recovery Act (RCRA) Interim Status regulated unit at the Fort Wingate Depot Activity (FWDA), located in Gallup, New Mexico. Specifically, this plan addresses the site investigation and closure of the Open Burning and Demolition Area (OBDA).

This amended Interim Status Closure Plan is being submitted as required under the State of New Mexico-Hazardous Waste Management Regulations (HWMR), Part VI-Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities. HWMR Part VI has incorporated the regulations (except as otherwise omitted) of the United States Environmental Protection Agency (USEPA) as set forth in 40 CFR Part 265. These regulations are hereafter referenced in this Closure Plan.

This Closure Plan additionally is being submitted as required by 40 CFR 265.112(c) to acknowledge the current expected date of closure and as the required notification of final closure of the OBDA.

1.2 BACKGROUND

The FWDA is a United States Army depot whose former mission was to store, ship, and receive materiel and to dispose of obsolete or deteriorated explosives and ammunition. The active mission of the FWDA ceased in January 1993.

The regulated unit at FWDA was listed on FWDA's RCRA Part A Permit Application, dated August 1980, as an open burning/open detonation (OB/OD) activity. The OBDA formerly operated under Interim Status (EPA ID No. NM 6213820974) and the regulations of 40 CFR 265.382, open burning; waste explosives and an Interim Status Closure Plan had been submitted to and is currently on file at the State of New Mexico-Environmental Department (NMED). Additionally, a RCRA Part B Permit Application for open burning/open detonation had been submitted to USEPA Region VI and the NMED in November 1988.

Subsequent to submittal of the Part B Permit Application, the Defense Authorization Amendments and Base Closure and Realignment Act of

1988 mandated the closure or realignment of military bases to economically maximize Army activities without affecting military operations. A total of 111 installations were recommended for either closure or realignment in 1988 by the Base Realignment and Closure Commission. The FWDA was one of the installations targeted for closure and disposal by the United States Army.

In response to the base closure activities, the Part B Permit Application was withdrawn in November 1992 and the (Interim Status) closure of the regulated unit is now being implemented under the Base Closure Environmental Program conducted by the United States Army Environmental Center (USAEC), formerly the United States Army Toxic and Hazardous Materials Agency (USATHAMA), located in Aberdeen, Maryland. This Interim Status Closure Plan has been prepared for the USAEC by Environmental Resources Management, Inc. (ERM) in partial fulfillment of Contract No. DAAA15-91-D-0011, Delivery Order No. 5.

Concurrently and as part of Delivery Order No. 5, environmental investigation activities are in progress at the FWDA as part of the Base Closure Program to determine the nature and extent of identified contaminant releases to soils, ground water, sediments, and surface waters from the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) previously identified for investigation and evaluation. When appropriate, the planned RCRA closure activities will be coordinated and integrated into the Base Closure Environmental Investigation (EI) activities.

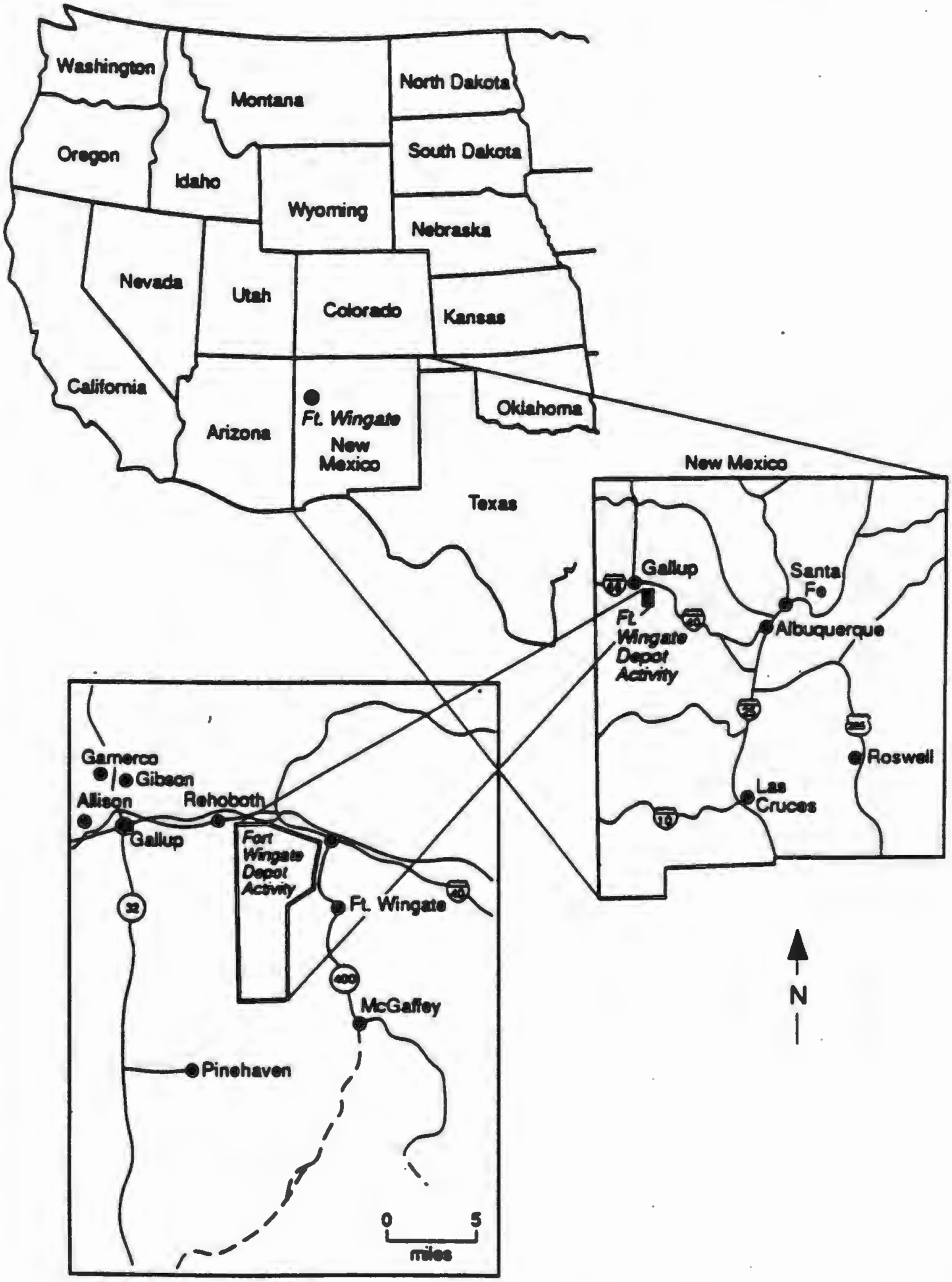
1.3 DESCRIPTION OF THE FACILITY

The FWDA is located in northwestern New Mexico. The installation is 32 miles east of the Arizona border and 10 miles east of Gallup, New Mexico, in McKinley County. Figure 1-1 shows the location of Fort Wingate, and Figure 1-2 is a map of the Depot showing the location of the OBDA.

FWDA encompasses 22,120 acres with facilities formerly used to operate a reserve storage activity providing for the care, preservation, and minor maintenance of assigned commodities, mostly ammunition. The installation mission had included the disassembly and demilitarization of outdated and unserviceable ammunition. Ammunition maintenance facilities existed for the clipping, linking, and repacking of small arms ammunition.

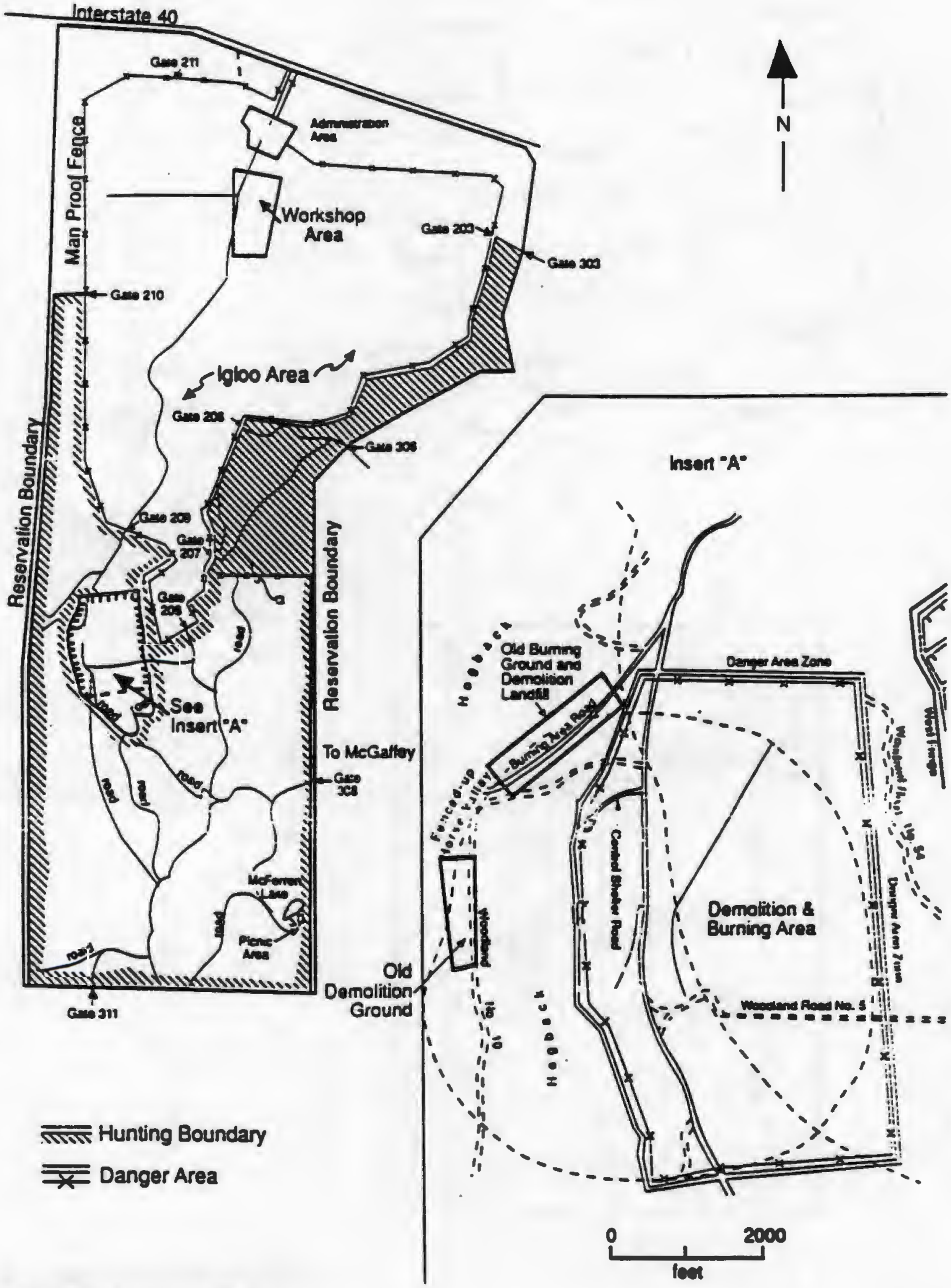
No chemical or biological agents or radiological materials were stored, manufactured, or tested at FWDA. The types of explosives and materiel

Figure 1-1
Location of Fort Wingate Depot Activity



Source: "Master Environmental Plan:
Ft. Wingate Depot Activity, Gallup New Mexico,"
December 1990

Figure 1-2
Location of Burning and Demolition Area



Source: "Master Environmental Plan:
Ft. Wingate Depot Activity, Gallup New Mexico,"
December 1990

treated or destroyed at FWDA are listed in Appendix A of this Closure Plan.

As previously stated, the FWDA is currently undergoing installation closure and property transfer. The installation is under the administrative command of the Tooele Army Depot (TEAD), located near Salt Lake City, Utah.

Open Burning and Demolition

Previously, as part of routine ammunition operations, FWDA handled and stored munitions items. Each year, quantities of munitions and munitions-related material were disposed of as waste. These wastes included items in storage which had failed quality assurance tests, out-of-date and obsolete explosives, propellants, munitions and munitions components. Other related waste for disposal included material which may have potentially become contaminated by munition during storage and handling. Disposal of these items at FWDA was accomplished by open burning and open detonation (OB/OD).

The OB/OD facilities at FWDA consisted of units used to thermally treat various propellants, explosives, pyrotechnics (PEP) and related items, in order to render them demilitarized. "Burning" involves the high temperature oxidation of fuel with the release of heat and combustion products. "Open burning" involves the burning of materials in the open air, either on the ground surface or in a containment device, without significant control of the combustion.

"Detonation" is a process in which explosives undergo a chemical reaction in conjunction with a type of shock wave, commonly referred to as a detonation wave. Demilitarization/treatment through detonation of accumulated munitions, ammunition, etc. is typically performed through the intimate contact placement and detonation of demolition material (i.e., explosives) on the ground or within an earthen area (i.e., demolition pit or crater). This results in the areal expulsion or "kick-out" of dirt and debris and potentially un-treated "unexploded ordnance" (UXO). The primary characteristics of the waste residue after treatment typically originates from heavy metals and traces of the PEP material.

FWDA Open Burning and Demolition Area

In the west central portion of the FWDA property, there are approximately 1,100 acres (close to 5% of the installation ground) fenced (six (6) foot high chain link fencing topped with barbed wire) and designated as the OBDA. Open burning and open detonation operations at FWDA were conducted at separate locations within the OBDA in an area encompassing approximately 125 acres. Open detonation of high explosives was performed at various locations on the ground within the OBDA. Open burning of waste propellants and pyrotechnics was performed both in burning trays or (in the past) on the ground within the delineated Burning Ground Area. Figure 1-3 provides a 1985 aerial photograph of the OBDA including the OB/OD facilities (the Burning Ground Area and demolition craters) existing in 1985 and Figure 1-4 provides a scale drawing of the area based on the aerial photograph and up-dated through visual field verification.

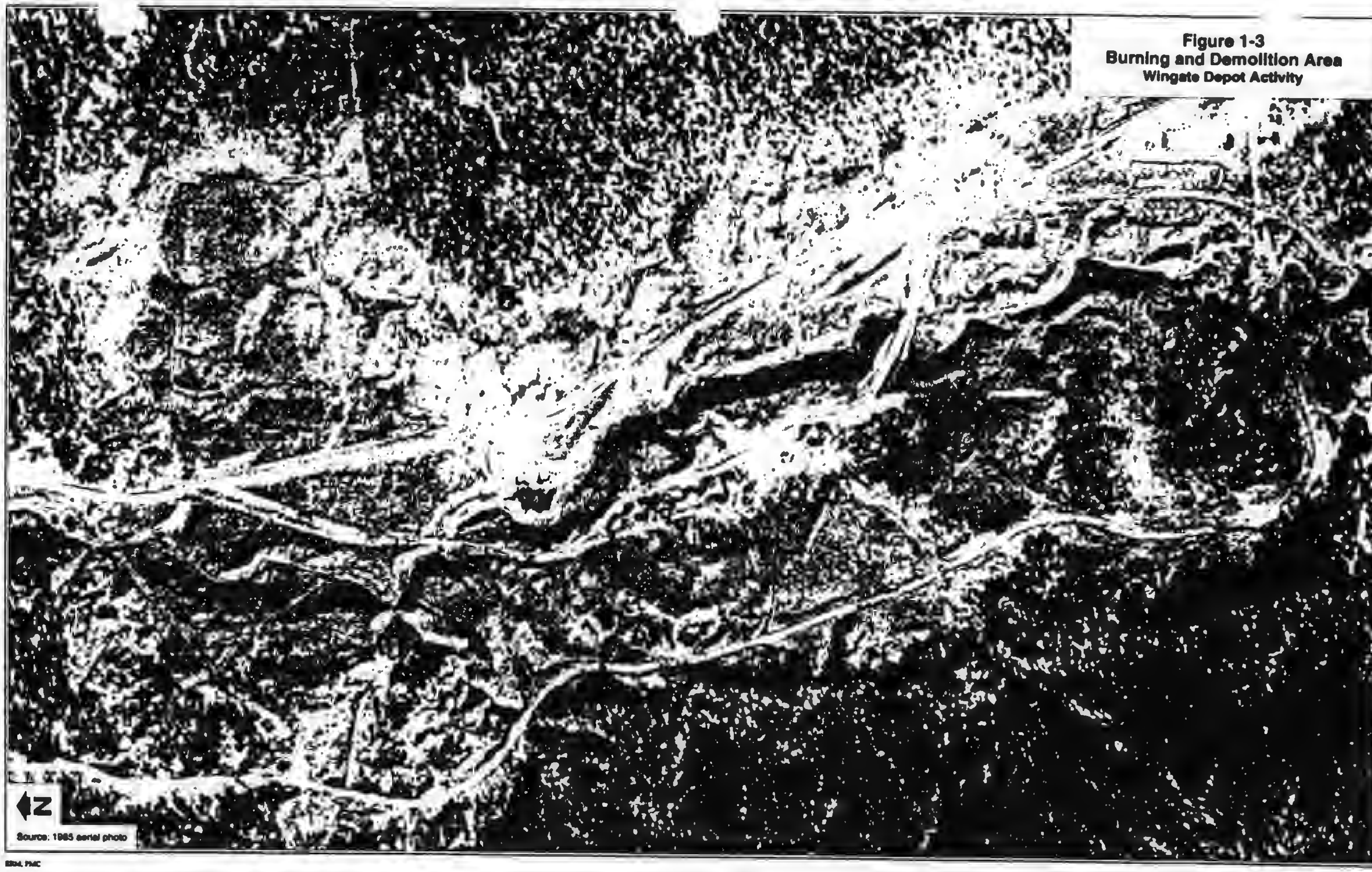
The old demolition ground and associated landfill also shown in Figure 1-2 were used to burn explosives and explosive-contaminated material from 1948 to 1955. These areas were certified clear and closed by the Army in 1955. After 1955, burning and detonation operations were transferred to the areas represented in Figures 1-3 and 1-4.

The FWDA Open Burning and Demolition Area and the OB/OD facilities are located in an area of the installation that contains no other development within several thousand feet. A control/security building and the Block House Shelter (both generally used only during operations at the OBDA) are both located approximately 2,000 feet from the OBDA and the distance to the Administration Area is approximately 2 3/4 miles. A perimeter fence consisting of a six (6) foot high chain link fence topped with barbed wire surrounds the area, which constitutes the exclusion zone around the OBDA. Access to the site is by an unimproved dirt road equipped with barricades (locked gates) and warning signs, advising that only authorized persons are permitted in the area.

The topographical location of the OB/OD facilities results in a natural drainage to an arroyo running from south to north within the OBDA. Additionally, a spring is located in the OBDA, as shown in Figure 1-4, within the arroyo and to the south of the Burning Ground Area. The spring has been tapped and is used to provide drinking water to a resident buffalo herd.

The detonation operations conducted at the OBDA has over time resulted in the wide-spread potential surface disposition and subsurface intrusion of both UXO and detonation related residue (i.e., metal fragments and debris). The areal impact has been estimated from visual surface surveys as encompassing approximately 1,380 acres radially from the OB/OD facilities. Further, the potential for UXO requires that visual and geophysical (magnetometry) surveys be performed prior to any surface access and that specific surface and subsurface monitoring be performed during the obtainment of soil samples and the installation of soil borings.

Figure 1-3
Burning and Demolition Area
Wingate Depot Activity



Source: 1985 aerial photo

BRM, PMC

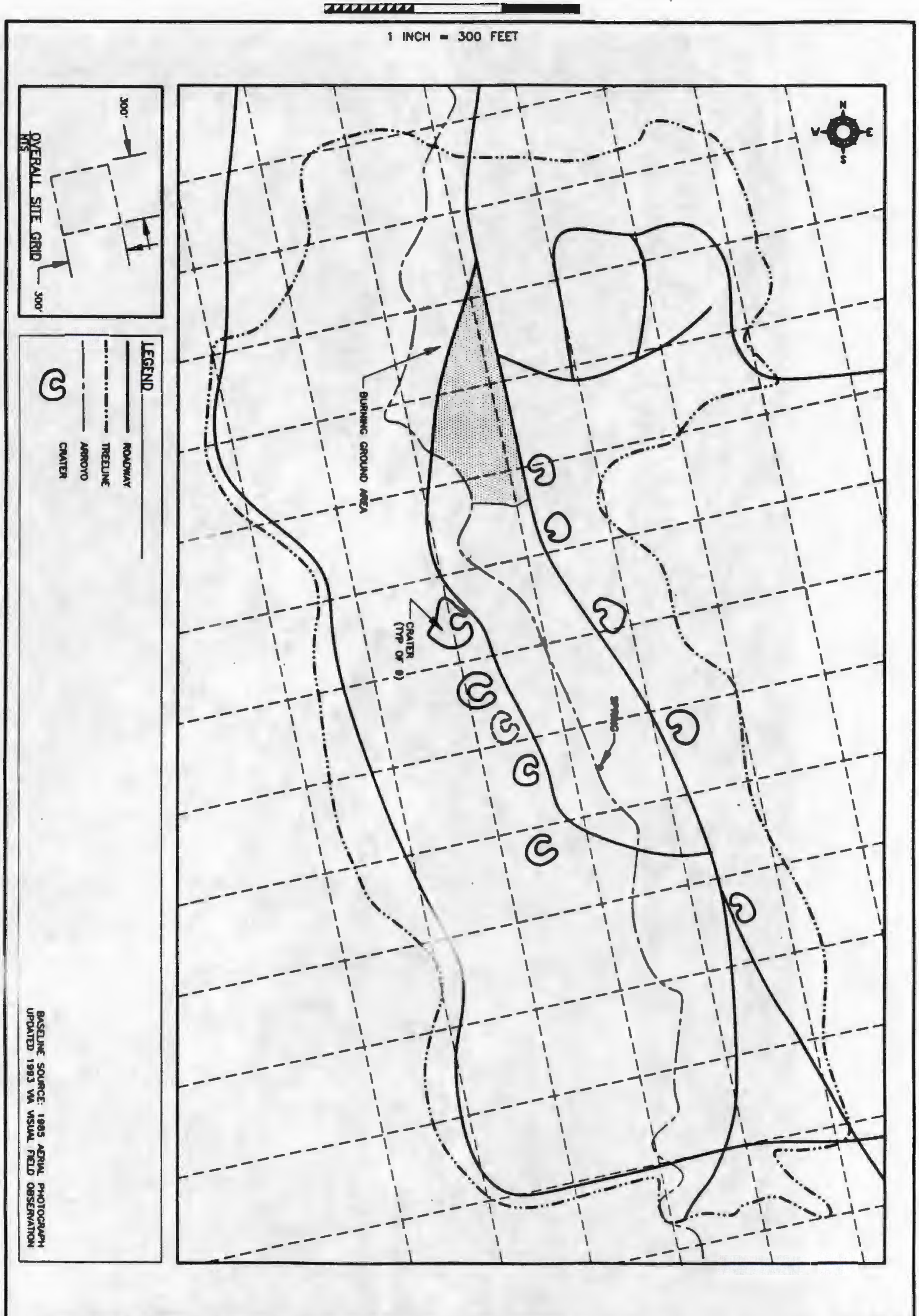


FIGURE 1–4	DESIGNED	CF	UNITED STATES ARMY ENVIRONMENTAL CENTER
	DRAWN	KAS	CONTRACT NO. DAAA15-D-0011/DA05
	CHECKED		FORT WINGATE DEPOT ACTIVITY
	DATE	02/23/93	GALLUP, NEW MEXICO
	JOB NO	N29003.0	OPEN BURNING AND DEMOLITION AREA
	FILENAME	N2900314	ERM

Open Burning Area

The main burn or Burning Ground Area within the OBDA is located on the eastern side of a valley immediately adjacent to the arroyo. The site has been used since 1955. Before 1982, explosives and explosives-contaminated dunnage (i.e., cardboard, wood pallets, etc.) were burned in the open without containment.

Since 1982, open burning was conducted in two burning troughs and two burning trays located within the delineated Burning Ground Area. The dimensions of the existing Burning Ground Area are approximately 350 ft x 75 ft and two (2) burning trays remain in place.

The troughs and trays were built to Army specifications and explosives (i.e., from screw top munitions, pyrotechnics, and initiators) and explosives-contaminated dunnage were burned following strict safety protocols. Waste materials typically were already disassembled from the cartridge prior to transportation to the OBDA and then placed in the burning tray according to Standard Operating Procedures (SOP's).

The burning tray typically used for open burning provided containment of residual waste from explosives demolition and the resultant ash to prevent contamination of the underlying soils, ground water and surface waters. The burning tray was constructed to contain any ash generated and any initiating fluids that may have been required and was equipped with a removable cover to keep precipitation out. The color of the ash usually ranged from white to black with occasional reds. The texture of the ash ranged from light flakes to solid char and was often seen as crumbly, granular cake. The burning tray was kept covered at all times except during operations. Part of the residue from the burning operations was sent to the Defense Reutilization and Marketing Office (DRMO), and the rest disposed of in residue piles. Past activities at the OBDA, particularly the disposal of burning ground residues into the arroyo, may have impacted soils/sediments in this area.

Open Detonation of High Explosives

Ten (10) demolition areas or craters are currently visible within the OBDA. The craters are positioned on both sides of the arroyo, as shown in Figure 1-3. The demolition areas or craters are similarly constructed, consisting of a graded central area surrounded on three sides by continuous bermed walls, typically 10-15 feet in height.

Historically, the demolition pits were established at various locations throughout the OBDA and used for demilitarization (demil) operations involving up to 5,000 lbs. of explosives above the ground and up to 10,000 lbs. of explosives with earth cover. Explosives and other materials to be detonated were placed in the center of the horseshoe-shaped crater. SOP's were utilized for the demilitarization of munitions by open detonation and the materials to be destroyed were carefully placed accordingly. Following detonation, the resultant crater-earthen area was graded to reform the demolition pit(s) and the area(s) reused.

As previously discussed, because there are no historical records to indicate the years of operation for specific craters, the existing ten (11) visually identifiable craters will be investigated under this closure plan.

Waste Materials

Materials which were thermally treated at FWDA included conventional munitions, propellants, pyrotechnics, and explosives. As part of the materials' manufacturing processes, these items are specifically designed to combust or explode completely (99.999%), providing typically for a minimal potential for remaining undetonated materials.

After detonation operations were completed at FWDA, the grounds surrounding the detonation pit were inspected and any undetonated material was treated on-site to prevent any unnecessary hazard to personnel. Therefore, all material to be demilitarized by open detonation was treated to maximum completeness to render reactive material non-reactive.

Open burning operations were conducted in pans and after operations were completed, any uncombusted material was subjected to a re-burn to insure that all material was thoroughly rendered unreactive.

The resultant waste material from the OB/OD facilities is therefore expected to be the residual constituents from the munitions, propellants, pyrotechnics and explosives from the treatment operations.

A four-year study conducted by the Army, between March 1981 and March 1985 (Reference Nos. 1 & 2), concluded that soils contamination was limited to the top 18 inches of the soil profile at all installations investigated with OB/OD operations. Contamination was defined as concentration of the EP Toxicity metals exceeding applicable limits. Lead, cadmium, and barium were the most significant metals. Only one of the sites investigated had soil contamination below 18 inches. This contamination was primarily due to a buried OB pad found at a depth of 4 feet below the surface.

As stated in the Army study, of the 21,574 analyses performed for EP Toxic metals, 99% of the 21,574 analyses fell below the RCRA limits for metals. The explosives most frequently detected in significant concentrations (> 1,000 ug/g) were, in order of decreasing frequency of detection, TNT, 2,4-DNT, RDX, HMX, and 2,6-DNT. 98.7% of all explosive analyses were well below the 1,000 ug/g baseline level chosen as a conservative level for reactivity. In addition, recent Army evaluations have shown no reactivity (i.e., utilizing established Bureau of Mines Reactivity Tests) with explosives concentrations as high as 100,000 ug/g.

As listed in the Army study, of the [illegible] analyses performed for all Toxic [illegible] of the [illegible] analyses [illegible] below the RCRA limits for metals. The explosives most frequently detected in significant concentrations (>1,000 mg/kg) were [illegible] in order of decreasing frequency of detection, TNT, 2,4-DNT, RDX, HMX, and 2,6-DNT. 99.5% of all explosive analyses were well below the 1,000 mg/kg baseline level chosen as a conservative level for reactivity. In addition, [illegible] Army evaluations have shown no reactivity [illegible] Bureau of Mines Reactivity Tests with explosive concentrations as high as [illegible]

2.0 CLOSURE PLAN OVERVIEW

2.1 BASIS OF CLOSURE [40 CFR 265.111]

The planned Interim Status closure of the OBDA will be performed as required under 40 CFR 265.111 in a manner that:

- minimizes the need for further maintenance, and
- controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere, and
- complies with the applicable requirements for closure and post-closure care (if required).

The active mission of the FWDA ceased in January 1993 and the OB/OD facilities were reportedly last used in October of 1992. This Closure Plan is therefore being submitted in concurrence with the Base Closure Program and as required by 40 CFR 265.112(c) to acknowledge the date of regulatory closure and as the required notification of final closure of the OBDA.

Regulated Unit

The regulated unit at the OBDA includes the open burning and detonation facilities. As previously discussed, since 1982 at the FWDA open burning was conducted in two burning troughs and two (2) burning trays located within the delineated Burning Ground Area. The two (2) burning trays currently remain in the Burning Ground Area. The historical number, period of use, and location(s) of demolition areas or craters however, is difficult to confirm (in order to provide distinction between potential solid waste management units and interim status units) because of the nature of the detonation activities (i.e., detonation kick-out and regrading and reforming of the demoltion pits).

Figure 1-4 provides a delineation of the Burning Ground Area and the demolition craters existing as of 1985 (the source date of the referenced aerial photograph). This has been updated via field verification to depict the ten (10) visually identifiable craters existing at the time of closure.

At closure, the OB/OD facilities consisting of the Burning Ground Area, the two (2) burning trays, and all of the existing demolition areas or craters will be included in the performance of closure.

The previous detonation/treatment operations at the FWDA OBDA also establish the potential for surface and subsurface UXO and metal objects related to the munitions, propellants, pyrotechnics and explosives to exist. A UXO survey will be required to provide access within the OBDA for the closure sampling activities and specific safety procedures will be required in the performance of intrusive sampling activities. Further, a UXO survey and evaluation will be performed as part of the Base Closure EI Program.

Proposed Closure Implementation

The required closure sampling will be performed in two (2) phases. In the first phase, field screening will be performed to identify areas of concern within the OBDA and to direct the more comprehensive sampling and analysis to be performed in the second or closure confirmation phase. This will focus the areas within the OBDA requiring intrusive sampling activities and minimize the required access to potential UXO areas and the potential hazards to field sampling personnel.

The proposed field screening parameters include the explosives: TNT and RDX which will be screened for throughout the OBDA and volatile organic compounds (VOCs) which will be additionally screened in the Burning Ground Area.

As discussed in Section 1 of this Closure Plan, previous studies (Reference Nos. 1 & 2) have found that the explosives at installations with OB/OD operations most frequently detected in significant concentrations (> 1,000 ug/g) were, in order of decreasing frequency of detection, TNT, 2,4-DNT, RDX, HMX, and 2,6-DNT. TNT and RDX can be analyzed in the laboratory on a quick turn around basis using field analytical methods and have therefore been selected as screening parameters for the detonation operations. Field screening for VOCs in the Burning Ground Area can be performed using a portable field instrument and is being performed to provide a relative assessment of the areal impact of the burning operations.

Following review and evaluation of the field screening program, a closure plan modification request will be submitted to the NMED detailing the proposed closure confirmation sampling. These samples will then be analyzed for the selected closure parameters to determine whether hazardous wastes or constituents remain above the established action levels and confirm the completion of closure, as described in detail in Section 3 of this Closure Plan.

The expected contaminants of concern at the OBDA (heavy metals and explosives related compounds) are not typically mobile, particularly given the arid conditions at FWDA. Depth to groundwater at FWDA and the surrounding areas is typically greater than 1000 feet.

However, a spring is located in the OBDA, as shown in Figure 1-4, within the arroyo and to the south of the Burning Ground Area. The spring represents a localized point of ground water discharge. The source of this ground water is assumably in the hogback located to the west of the OBDA. Because this ground water discharge is the result of upward (positive, vertical) ground water gradients, it is unlikely that potential contamination from the OB/OD Area could migrate downward into the deep regional aquifer. The spring is being sampled as part of the Base Closure EI Program and the results of the sampling will be evaluated as part of the performance of closure.

Further, as noted in Army studies (Reference Nos. 1 and 2), data obtained from 109 wells around 19 OB/OD units indicated no ground water contamination where evaporation exceeded precipitation by 8 inches per year. This is because in arid regions, meeting this criterion, there is no driving force to leach potential contaminants into the water table. Additionally, the solubilities of the identified primary explosives of concern are very low (TNT- 130 mg/L @ 20 DEG C; DNT - 300 mg/L @ 20 DEG C; RDX - 76 mg/L @ 25 DEG C, and HMX - 35 mg/L @ 22.5 DEG C) minimizing the potential for ground water contamination.

It is not then expected that ground water has been impacted by activities at the OBDA, and no ground water sampling program is planned in this area. However, the subsurface soils investigation will include sampling to confirm this assumption.

The subsurface soils investigation will include sampling to determine the levels of hazardous constituents above the naturally occurring background levels within the selected sampling locations of a 10-foot thick unit of soil (i.e., at the ten [10] foot depth below the surface or at a depth which is ten [10] feet deeper than the last sample collected which showed no concentrations of hazardous constituents above the naturally occurring background levels).

2.2 *CURRENT STATUS/MAXIMUM WASTE INVENTORY*

The active mission of the FWDA ceased in January 1993. The operational activities at the regulated OB/OD facilities reportedly ended as of October 1992 with the removal of all remaining ammunition and munitions from the FWDA. Therefore, there will be no final volume of wastes to be received at the OB/OD facilities and no remaining waste inventory at the OBDA.

2.3 *PARTIAL CLOSURE*

It is not intended that partial closure be performed of the OB/OD facilities at the FWDA. This Closure Plan has therefore been prepared to address complete closure of the subject facilities.

2.4 *CLOSURE SCHEDULE*

Following approval of the Closure Plan by NMED, closure activities for the OBDA will be initiated as described in the Schedule of Activities provided in Section 5 of this Plan.

2.5 *FACILITY CONTACT*

The contact for questions concerning this Closure Plan is:

Mr. Larry D. Fisher
Environmental Engineer
Directorate of Industrial Risk Management
Tooele Army Depot
SDSTE-IRE
Tooele, Utah 84074
(801) 833-3504

3.0 PERFORMANCE OF CLOSURE

3.1 PRECLOSURE ACTIVITIES

UXO Survey

Prior to the initiation of both field screening and closure activities, the delineated areas within the OBDA where sampling is to be performed will be located and the proposed sampling locations (grids) identified and marked. A UXO survey will then be initiated to evaluate the existence of unexploded ordnance or unexploded propellants, explosives, and pyrotechnics (PEP). The UXO survey activities will clear safety zones around proposed sampling locations and access paths from established roadways to the safety zones to allow safe entry and exit of equipment and personnel. Surface clearance and down-hole monitoring for potential subsurface UXO to a depth of 12 feet or until undisturbed/native soil is observed will be performed at all proposed boring locations (12 feet or until undisturbed soil is encountered is a generally accepted depth of UXO impact/intrusion from detonation operations)

In addition, the UXO survey will attempt to determine the potential areal impact of the detonation activities on the surrounding area (i.e., resulting from detonation kick-out). A surface survey and removal of identified ordnance debris will be performed within the delineated OBDA (see Figures 1-3 and 1-4). Live ordnance will be staged (if deemed safe to move) in an identified demolition area for final on-site disposition by the responsible Army Explosive Ordnance Demolition (EOD) unit. Ordnance which is too sensitive or dangerous to move will be marked for visual relocation and on-site disposal by the Army EOD unit. The Work Plan for UXO Support Services is included as Appendix B in this closure plan.

Background Sampling

Background samples for the FWDA will be collected as part of the planned EI activities. In addition, because of the size of the FWDA (approximately 22,000 acres) and the probability for variable background conditions, samples from the OBDA will be collected to determine the naturally occurring background concentrations of metals at the site. Three sampling locations will be selected in areas not impacted by OB/OD activities, with 4 samples collected from each location for a total of twelve (12) background samples. The four (4) samples at each location will be collected from depths of 0 - 6 inches, 2 - 2.5 feet, 5 - 5.5 feet, and 7 - 7.5 feet.

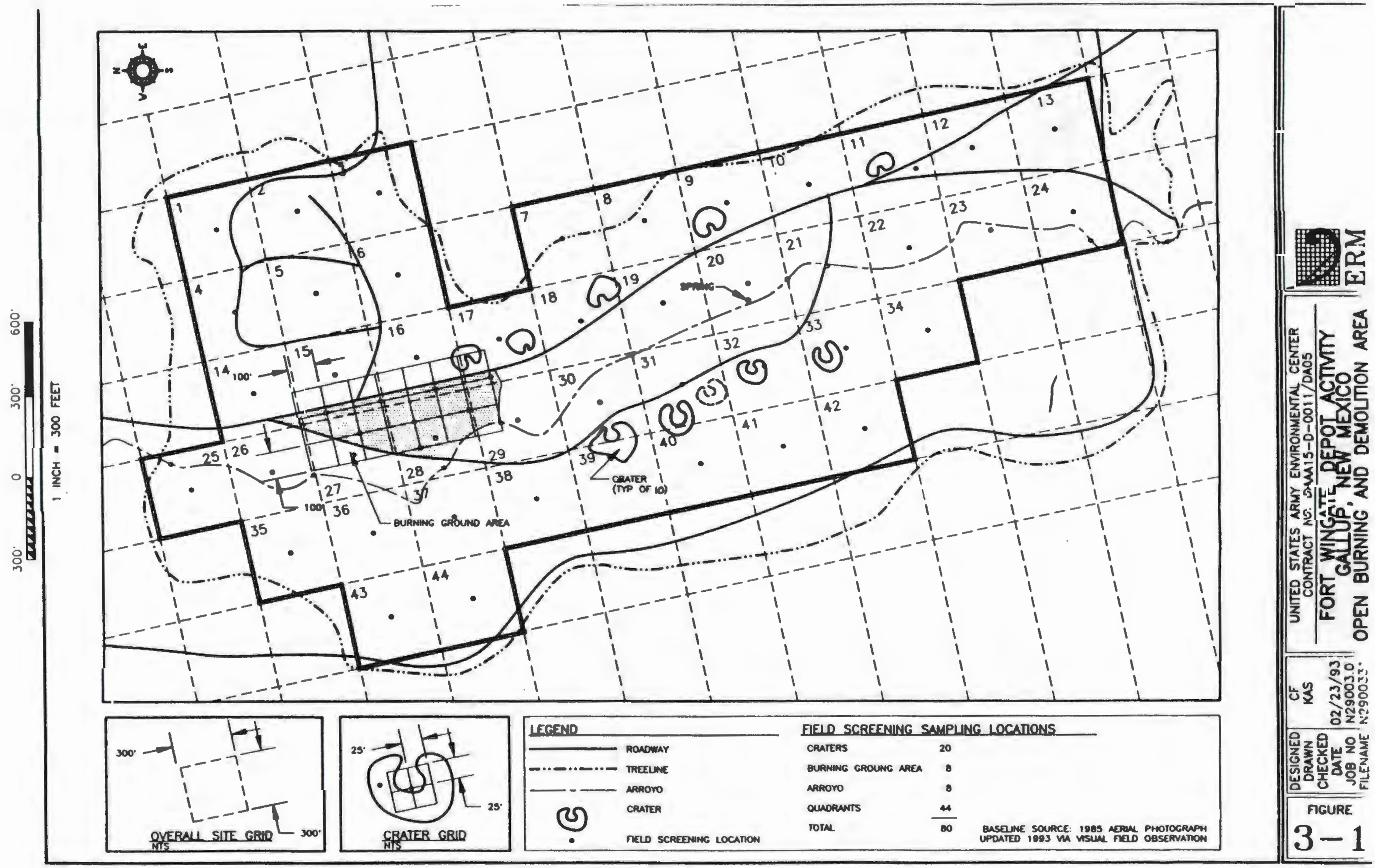
All samples will be analyzed for the established metals of concern at the site as discussed in Subsection 3.2 of this Closure Plan. The results of this sampling will be used to determine a background concentration range for each established metal of concern. A range, rather than a single concentration, is believed to best represent the variety of soil types present at the site and the mixing of soils that occurred during routine operations in this area. These data will then be compared to the site naturally occurring contaminant concentrations using a one-tailed "t" test at the 95% confidence level in accordance with Environmental Protection Agency (EPA) guidance contained in Soil Sampling Quality Assurance User's Guide, 2nd edition, EPA/600/8-89/046, March 1989.

Field Screening Program

A field screening program will be implemented to identify areas of concern within the OBDA and to direct the more comprehensive closure confirmation sampling and analysis to be performed in the second phase of field investigation. This will focus the areas within the OBDA requiring intrusive sampling activities and minimize the required access to potential UXO areas and the potential hazards to field sampling personnel.

The proposed field screeing parameters include the explosives TNT and RDX, which will be screened for throughout the OBDA and volatile organic compounds (VOCs) which will be additionally screened in the Burning Ground Area. A sampling grid on 300-foot centers will be established across the OB/OD area, as shown on Figure 3-1, creating forty-four (44) quadrants. One (1) grab sample will be collected at approximately the center of each of the forty-four quadrants.

A second grid will then be established across the Burning Ground Area on 100-foot centers and eight (8) grab samples will be collected accross the Burning Ground Area at the locations shown on Figure 3-1. In addition, each of the existing ten (10) demolition craters will be grab sampled at the center of the crater and a composite sample will be collected along the inner bermed wall of each crater (2 samples/crater; 20-total samples). In addition, eight (8) grab sediment samples will be collected from along the arroyo at the locations shown on Figure 3-1. All soil samples will be collected as a composite of the surface-to-1-foot depth. A total of eighty (80) samples will be collected for field screening laboratory analysis. Samples from the Burning Ground Area will also be field screened for volatile organic compounds at the same eight (8) explosives screening locations using a portable field instrument. Table 3-1 summarizes the proposed field screening sampling program.



1 INCH = 300 FEET
0
300'
600'
SPRING
CRATER (TYP OF 10)
BURNING GROUND AREA
100'
OVERALL SITE GRID
NTS
300'
CRATER GRID
NTS
25'
LEGEND
ROADWAY
TREELINE
ARROYO
CRATER
FIELD SCREENING LOCATION
FIELD SCREENING SAMPLING LOCATIONS
CRATERS 20
BURNING GROUND AREA 8
ARROYO 8
QUADRANTS 44
TOTAL 80
BASELINE SOURCE: 1985 AERIAL PHOTOGRAPH UPDATED 1993 VIA VISUAL FIELD OBSERVATION
ERM
UNITED STATES ARMY ENVIRONMENTAL CENTER
CONTRACT NO. DAAA15-D-0011/DA05
FORT WINGATE DEPOT ACTIVITY
GALLUP, NEW MEXICO
OPEN BURNING AND DEMOLITION AREA
DESIGNED CF
DRAWN KAS
CHECKED
DATE 02/23/93
JOB NO N29003.0
FILENAME
FIGURE
3-1

Table 3-1
Summary of Proposed OBDA
Field Screening

Location	No. of Field Screening Samples	Field Duplicate Samples at 25%	Field Blanks (1 in 20)	Equipment Rinsates (1 in 20)
Explosives Screening				
Burning Ground Area	8	2	1	1
OBDA Quadrants	44	10	2	2
Arroyo	8	2	1	1
Craters	20	5	1	1
Total	80	19	5	5
		Total =	109	

Volatile Organic Compounds (VOC) Screening

VOC Screening will be performed using field instrumentation at the same eight (8) Burning Ground Area sampling locations selected for explosives field screening

NOTE: Trip Blanks will be generated based upon the frequency of sample shipment.

All soil samples collected during the field screening will be sent to an analytical laboratory for analysis for RDX and TNT using a modified USAEC (USATHAMA) method that provides a quick turn-around-time (TAT).

3.2 *CLOSURE PARAMETERS AND ACTION LEVELS*

The existing OBDA consists of areas previously used to thermally treat various PEP and related items, in order to render them demilitarized. Other wastes that were open detonated included inert parts which contain no hazardous constituents, or characteristic or listed hazardous wastes. The categories of wastes treated at these facilities consisted primarily of military energetic materials that had exceeded their shelf life and off-specification versions of these same materials. The off-specification items generally were composed of the same raw materials as the usable items, but did not meet performance specifications.

Based on previous studies (Reference Nos. 1 and 2), the primary hazardous constituents of the waste residues resulting from thermal treatment will include heavy metals and possibly traces of the PEP materials (i.e., explosives). Further, Appendix A provides excerpts from the RCRA Part B Permit Application submitted to the NMED in November 1988, listing and describing the various PEP materials historically handled at the OBDA. In addition, the results of previous sampling programs at the OBDA summarized in the "Master Environmental Plan, Fort Wingate Depot Activity, Gallup, New Mexico" (Reference No. 4) were reviewed. The sampling results applicable to the OBDA have been excerpted from the Master Environmental Plan" and provided as Appendix C to this Closure Plan. From this review, closure parameters representative of the managed materials have been selected and provided in Table 3-2.

The explosives in Table 3-2 consist of those compounds listed in Appendix A or identified through the review process for which analytical methods exist. (This includes most of the explosives handled at FWDA.) Metals of potential concern that were listed as constituents of any compound in Appendix A or identified in the review process were also included for analysis. Metals typically considered ubiquitous in the environment and generally not classified as "hazardous", including sodium, potassium, phosphorus, and magnesium were not included. In addition as a confirmatory measure, selected samples (i.e., 25%) will be analyzed for the TCL volatile and semivolatile listed constituents.

Action levels for the constituents listed in Table 3-2 were developed according to the NMED-approved procedures described in the proposed

Table 3-2
Closure Parameters
Ft. Wingate, NM

Constituent	Synonym	Carcinogenic Classification	Soil Action Level mg/kg	USATHAMA Method	Similar USEPA Methods
Explosives:					
Cyclotetramethylenetetranitramine	HMX	D	4000 (2)	LW37	SW-846 8330
Cyclotrimethylenetrinitramine	RDX	C	64 (2)	LW37	SW-846 8330
Nitrobenzene		D	40 (1)	LW37	SW-846 8330
1,3-Dinitrobenzene	1,3-DNB	D	8 (1)	LW37	SW-846 8330
1,3,5-Trinitrobenzene	1,3,5-TNB		4 (2)	LW37	SW-846 8330
2-Nitrotoluene			800 (2)	LW37	SW-846 8330
3-Nitrotoluene			800 (2)	LW37	SW-846 8330
4-Nitrotoluene			800 (2)	LW37	SW-846 8330
2,4-Dinitrotoluene	2,4-DNT	B2	1 (1)	LW37	SW-846 8330
2,4,6-Trinitrotoluene	TNT	C	40 (2)	LW37	SW-846 8330
2,4,6-Trinitrophenylmethylnitramine	Tetryl		800 (2)	LW37	SW-846 8330
Pentaerythritol	PETN		NC	LW37	SW-846 8330
Nitroglycerin			NC	LW37	SW-846 8330
TCL Volatile Organic Compounds			NC	LM26	SW-846 8240
TCL Semivolatile Organic Compounds			NC	LM20	SW-846 8270
Metals:					
Aluminum	Al		NC	JS19	SW-846 6010
Antimony	Sb	D	30 (1)	JS19	SW-846 6010
Bismuth	Bi		NC	NA	NA
Barium	Ba	D	4000 (1)	JS19	SW-846 6010
Boron	B		7200 (2)	NA	SW-846 6010
Cadmium	Cd	B1	40 (1)	JS19	SW-846 6010
Chromium	Cr	A	400 (1)	JS19	SW-846 6010
Mercury	Hg	D	20 (1)	JB12	SW-846 7000 Series
Nickel	Ni	D	2000 (1)	JS19	SW-846 6010
Selenium	Se	D	400 (2)	JD27	SW-846 7000 Series
Zinc	Zn	D	16000 (2)	JS19	SW-846 6010
Lead	Pb	B2	1000 (3)	JD27	SW-846 7000 Series

(1) Action levels as reported in proposed Federal Register Notice 55 FR 30865-30873, Appendices A-F
(2) Action levels calculated using available RfD and CPF data and the methods defined in proposed Federal Register Notice 55 FR 30865-30873, Appendices A-F
(3) This action level is based on the OSWER Directive #9355.4-02 for soil cleanup on CERCLA Sites (Sept. 1989)
NC = Not Calculated
NA = Not Available

Federal Register notice 55 FR 30865 - 30873, Appendices A through F and are provided in Table 3-3. According to these procedures, action levels for soils are developed by calculating the concentration in soil that represents the most stringent of the following:

- for Class A and B carcinogens, a lifetime excess cancer risk of 10^{-6},
- for Class C carcinogens, a lifetime excess cancer risk of 10^{-5},
- for systemic toxicants, a hazard index of 1.0.

The calculations are based on using the currently available health-based concentration data, published as reference doses (RfD) for systemic toxicants and as carcinogenic slope factors (CSF) for carcinogens. A sample action level calculation and summaries of the exposure assumptions have been provided in Appendix D of this Closure Plan. Where no RfD or CSF data are available, toxicity data may be used by NMED to calculate appropriate action levels. Appendix D also includes toxicity data for those compounds for which no RfD or CSF was available. (Note that no action levels have been calculated for the TCL volatiles and semivolatiles, as these compounds are not specifically included in the Appendix A list of constituents treated at the OB/OD area. Action levels for specific compounds will be developed if needed following sample analyses.)

3.3 SPECIFIC CLOSURE PROCEDURES

Based upon the results of the field screening, additional soil sampling will be conducted at the OBDA to perform closure confirmation and determine the areal and vertical extent of hazardous constituents. Areas showing screening levels of RDX and/or TNT above the action levels will be resampled for all the constituents of concern, as listed in Table 3-2. In addition, areas of obvious disturbance, such as the Burning Ground Area and the demolition craters, will be resampled. An outline of the closure confirmation sampling program is presented in Section 3.4, with details to be provided in a closure plan modification request that will be submitted to the NMED following review of the field screening results.

Soil cleanup levels will also be developed at this time for the compounds listed in Table 3-2. Cleanup levels will be developed according to the procedures defined in the proposed Federal Register notice 55 FR 30798 (40 CFR 264.525 (d)). Although soil cleanup levels may be set at the same levels as action levels, action levels are developed under conservative assumptions that may not be appropriate for cleanup levels. While both action levels and cleanup levels are based on the same level of risk,

Table 3-3
Action Level Calculations
Ft. Wingate, NM

Constituent	Oral RfD mg/kg/d		Oral CPF (mg/kg/d)^-1		Carcinogenic Classification	Noncarcinogenic Action Level mg/kg	Carcinogenic Action Level, A-B Carcinogens mg/kg	Carcinogenic Action Level, C Carcinogens mg/kg
Explosives:								
Cyclotetramethylene-tetranitramine	5.00E-02	a	ND		D	4000		
Cyclotrimethylenetrinitramine	3.00E-03	a	1.10E-01	a	C	240		64
Dinitrobenzene,1,3-	NA		NA		D			
Dinitrotoluene,2,4-	2.00E-03	a	**		B2	160		
Nitrobenzene	NA		NA		D			
Nitroglycerin								
Nitrotoluene,2-	1.00E-02	b				800		
Nitrotoluene,3-	1.00E-02	b				800		
Nitrotoluene,4-	1.00E-02	b				800		
Pentaerythritol								
Trinitrobenzene,1,3,5-	5.00E-05	a				4		
Trinitrophenylmethylnitramine,2,4,6-	1.00E-02	b				800		
Trinitrotoluene,2,4,6-	5.00E-04	a	3.00E-02	a	C	40		233
Metals:								
Aluminum								
Antimony	NA		NA		D			
Bismuth								
Barium	NA		NA		D			
Boron	9.00E-02	a				7200		
Cadmium	NA		NA		B1			
Chromium	NA		NA		A			
Mercury	NA		NA		D			
Nickel	NA		NA		D			
Selenium	5.00E-03	a	ND		D	400		
Zinc	2.00E-01	b	ND		D	16000		
Lead					B2			

** The CPF for this constituent is listed in HEAST as the Dinitrotoluene mixture 2,4-/2,6- on IRIS thus the listed Subpart S value for the Action level for these constituents was used.

a- IRIS Database acessed 2/93
b- HEAST FY1992
NA- not applicable because action level is established.
ND- no data because constiteunt is not carcinogenic.

cleanup levels may take into consideration more realistic exposure scenarios.

Analytical results of the closure sampling will be compared to the action levels using a one-tailed "t" test at the 95% confidence level in accordance with Environmental Protection Agency (EPA) guidance contained in Soil Sampling Quality Assurance User's Guide, 2nd edition, EPA/600/8-89/046, March 1989. If the analytical results of the closure sampling indicate that soils in a particular area are below the soil cleanup levels, then closure activities will be assumed to be complete at this location, and no further sampling will be performed. However, if the analytical results show concentrations of the closure parameters that exceed the established soil cleanup levels, additional sampling and analysis may be performed. Sampling may be conducted to determine the areal extent of contamination, or directed excavation may be implemented in the affected (i.e., hot spot) area, followed by additional sampling until clean closure is confirmed. Should additional sampling be required, a second closure plan modification request will be submitted to the NMED that:

- describes the areas which potentially exceed the established soil cleanup levels based on the preliminary sample results;
- describes the additional sampling and analysis necessary to determine the areal extent of contamination exceeding established soil cleanup levels;
- describes the details of excavation activities necessary in the affected areas to remove soils that are found to contain contamination above established soil cleanup levels; and
- provides a sampling and analysis plan to confirm that excavation activities were successful in removing contamination above established soil cleanup levels and that no hot spots remain above the established soil cleanup levels.

Any contaminated residue/soil exceeding the established soil cleanup levels will be removed, stabilized, or controlled to reduce the risks to acceptable levels. Excavated residue/soil to be removed from the site will be brought to a temporary staging area. At the staging area, the contaminated materials will be placed in DOT-approved containers (i.e., drums or lined roll-offs) for off-site transport, properly manifested, and transported to an approved hazardous waste management facility in accordance with 40 CFR 265.114. This activity will be performed as required to address the potential for UXO. If any UXO or unexploded PEP waste is encountered during excavation, such waste will be treated in place or brought to a designated area on site and temporarily stored until it can be safely treated on site.

At the OB area, the two (2) remaining burning trays and supporting metal structures will be either decontaminated in place during closure or decontaminated and removed from the site prior to the initiation of closure. Decontamination of the burning trays will be accomplished through "flashing", by using appropriate fuels and oxidizers to cause the temperature in the containment device to exceed the auto-ignition or decomposition temperature of the PEP wastes present in the pan. Any uncombusted material will be subjected to a re-burn to insure that all material was thoroughly rendered unreactive, resultant residues from the decontamination activities will be collected and managed as hazardous wastes and in the same manner as contaminated residue/soil. Five (5) wipe samples will then be obtained from each burning tray and the supporting metal structures and analyzed for the established closure parameters to confirm closure (i.e., analytical results below the established clean up levels).

3.4 *CLOSURE SAMPLING AND ANALYSIS*

The sampling and analysis program proposed for the performance of closure will be based upon the results of the field screening program and will be performed to be consistant with the Base Closure EI Program for FWDA. The primary objective of the EI is to determine the nature and extent of identified contaminant releases to soils, ground water, sediments, and surface water from the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) identified for investigation and evaluation at the FWDA. Appendix E provides excerpts detailing the sampling and analysis protocols to be utilized during the performance of closure from the Sampling and Analysis Plan of the "Environmental Investigation (EI) Work Plans for Areas Requiring Environmental Evaluation at Fort Wingate Depot Activity (FWDA)", November 1992.

The closure confirmation sampling at the OBDA will be submitted as a closure modification to the NMED and will be based upon the results of the field screening program. The overall anticipated sampling approach for closure of each area is outlined below. The protocols and procedures developed for the EI (and excerpted in Appendix E) will be utilized during the performance of closure. The samples will be sent to a contracted laboratory for analysis.

The objective of the closure sampling program will be to determine that levels of the selected closure indicator parameters are below the established soil cleanup levels to allow the confirmation of closure. As previously discussed, access to all locations within these areas will be surveyed by a UXO contractor prior to the initiation of investigation activities and during the performance of sampling activities.

Demolition Area

There are currently ten (10) visually identifiable demolition areas or craters as shown on Figure 3-1, that in effect divide the OBDA in half along the arroyo with demolition areas or craters on each side. During its years of operation, the entire area was continually regraded as the craters required reconstruction following each detonation event.

All of the demolition areas or craters are similarly constructed, consisting of a graded central area surrounded on three sides by continuous bermed walls, typically 10-15 feet in height. Explosives and other materials to be detonated were placed in the center of the horseshoe-shaped crater. Closure sampling in each of the craters will consist of surface and subsurface sampling of the graded central area and the surrounding berms of each of the ten (10) craters and sampling at areas of concern identified in the field screening program.

Burning Ground Area

The Burning Ground Area is located on the eastern side of the OBDA, immediately east of the arroyo, on a relatively level area and is approximately 350 feet by 75 feet in size. Two (2) burning trays previously used during the open burning operations still remain in the southern end of the area. Closure sampling of the Burning Ground Area will consist of collecting surface and subsurface soil samples along the established grid and at areas of concern identified in the field screening program.

Arroyo

The arroyo cuts across the OBDA in a generally north-south direction and contains a spring located south of the Burning Ground Area. The arroyo collects surface water runoff during periods of heavy rain, but is dry most of the year. Past activities at the site, particularly the disposal of burning ground residues into the arroyo, may have impacted soils/sediments in this area. Closure sampling will consist of collecting surface samples along the arroyo at areas of concern identified in the field screening program. The spring was sampled as part of the Base Closure EI Program. If analytical results from the EI Program spring sampling are below all applicable standards, then no further action will be proposed. If analytical results are above established standards, the closure sampling will consist of ten (10) samples obtained at locations down the arroyo from the spring. All samples will be analyzed for the identified chemicals of concern.

Subsurface Soils

As discussed in Section 2, ground water at the site is not expected to have been impacted by activities at the OBDA. However, a subsurface soil sampling program will be conducted to confirm this assumption. Closure sampling will consist of drilling an estimated 5 to 10 borings in areas where surface soils exceed established site soil cleanup levels. The borings will be sampled at two-foot intervals down to the depth required to determine the levels of hazardous constituents above the naturally occurring background levels within the selected sampling locations of a 10-foot deep unt of soil.

3.5 *HEALTH AND SAFETY*

A programmatic Health and Safety Plan (HSP) for the proposed EI field activities at FWDA has been prepared as part of the "Environmental Investigation (EI) Work Plans for Areas Requiring Environmental Evaluation at Fort Wingate Depot Activity (FWDA)", November 1992. This HSP has been prepared to describe the types and levels of hazards to be expected and the personnel protection that will be required during the EI Program. Emergency phone numbers and directions to emergency medical care are also included. The HSP will be available for use during the proposed closure activities.

3.6 *RECORDKEEPING*

Records will be maintained, documenting the closure activities. Permanent records will be maintained on file at the Tooele Army Depot (TEAD) and will include the following:

- Notations describing activities performed during sample collection, residual removal, and excavation activities (if required).
- Sampling results, particularly results verifying clean closure.
- Duties and records of the certifying licensed professional engineer.

In addition, USAEC will maintain a file regarding the Base Closure Environmental Program.

3.7 *POST-CLOSURE*

A post-closure plan is not required because the FWDA OB/OD facilities are not disposal facilities, and all wastes will have been removed prior to the initiation of closure, unless closure is not completed as noted in Section 8.0 and post-closure is implemented.

4.0 CLOSURE CERTIFICATION [40 CFR 265.120]

Following the final completion of the closure program and within 60 days, an independent registered professional Engineer and a representative of the Tooele Army Depot (TEAD) will inspect the site and certify that the OB/OD facilities have been closed in accordance with the approved Closure Plan. This final closure certification and notification of the completion of closure activities, signed by the Commanding Officer of the TEAD and the Engineer, will then be submitted by registered mail to the Secretary of the State of New Mexico Environment Department. Documentation to accompany the closure certification will include a final closure report.

The final closure report will contain, at a minimum and as appropriate, the following:

- a QA/QC summary on the adequacy of the analyses and the decontamination demonstration;
- a Construction Quality Assurance summary on the closure activities;
- a copy of the file of supporting documentation:
  - field log books,
  - laboratory sample analysis reports,
  - QA/QC documentation, and
  - Chain of Custody records;
- disposal location of all hazardous waste and hazardous waste residues;
- a narrative summary of all testing done during the closure activities;
- the details of any variance from the approved Closure Plan and the reason for the variance;
- the survey plat as specified in 40 CFR 265.16 (if necessary), and
- a certification of the accuracy of the report.

During the course of closure activities, the Engineer (or his designee) will have performed periodic inspections to ensure compliance with the Closure Plan. Closure activity milestones for the OB/OD facilities from which the periodic inspections will be scheduled will be provided in a specific closure operations schedule to be established following approval of the Closure Plan. The periodic inspections will be at the discretion of the certifying Engineer and activities during the inspections will, as a minimum, include the following:

- Review of records for closure and decontamination activities and manifests for materials and wastes shipped for off-site disposal.
- Review of closure-decontamination analytical data.
- Review of final closure-confirmatory sample collection records and analytical data.

The generated closure inspection records will be utilized in preparation of the final closure report and copies will be maintained at the TEAD. In addition, following submittal of the final closure certification and closure report, the NMED will be allowed to inspect the closed facility.

5.0 *SCHEDULE OF ACTIVITIES*

The schedule of activities for closure of the OB/OD facilities is dependent on the review, public comment, and approval of the Final Closure Plan by the NMED. It is anticipated that the schedule of activities for closure will be as follows:

Activity	Estimated Schedule
Submission of Final Closure Plan to NMED	1 March 1993
Review by NMED (including public comment)	1 March -1 June 1993
Begin closure operations	Following receipt of NMED approval

Closure activities will be completed in accordance with the approved Closure Plan and in coordination (as appropriate/applicable) with the performance of the Base Closure Environmental Program. A schedule for specific closure operations will be established following approval of the Final Closure Plan.

6.0 *CLOSURE COST ESTIMATE [40 CFR 265.142]*

FWDA is a federal facility. Under 40 CFR 265.140 (c), the Federal government is exempt from the requirements of 40 CFR Subpart H - Financial Requirements.

7.0 *FINANCIAL ASSURANCE FOR CLOSURE [40 CFR 265.143]*

FWDA is a federal facility. Under 40 CFR 265.140 (c), the Federal government is exempt from the requirements of 40 CFR Subpart H - Financial Requirements.

8.0 POST-CLOSURE

8.1 A post-closure plan is not required because the OB/OD facilities were not used for disposal and it is the intention of this Plan to remove all residual wastes and hazardous constituents to the established action levels in the performance of closure.

Should it be determined that closure cannot be confirmed and not all residual wastes and hazardous constituents can be practicably removed or decontaminated to the established action levels, then closure of the OB/OD facilities will be completed and post-closure will be implemented.

In the event that post-closure is required, a Post-Closure Plan will be submitted to the NMED for review and approval. The Post-Closure Plan will encompass applicable requirements of 40 CFR 265.117 - 265.120 and the following elements as required/applicable:

- Institutional controls regarding future land use and access (i.e., establishment and submittal of a survey plat).
- Post-closure security.
- Insect and rodent control.
- Landscape maintenance.
- Run-on/run-off and erosion control.
- Monitoring.
- Post-closure notices.
- Certification for post-closure care completion.

8.2 COST ESTIMATE FOR POST-CLOSURE CARE [40 CFR 265.144]

FWDA is a federal facility. In the event that post-closure is required, under 40 CFR 265.140 (c), the Federal government is exempt from the requirements of 40 CFR Subpart H - Financial Requirements.

8.3 FINANCIAL ASSURANCE FOR POST-CLOSURE [40 CFR 265.145]

FWDA is a federal facility. In the event that post-closure is required, under 40 CFR 265.140 (c), the Federal government is exempt from the requirements of 40 CFR Subpart H - Financial Requirements.

8.6 POST-CLOSURE

A post-closure plan is not required because the OB/OD facilities will be closed by removal and decontamination of Hazardous Residual Wastes and hazardous constituents as the result of the performance of closure.

Should it be determined that closure cannot be performed and residual wastes and hazardous constituents cannot be practicably removed or decontaminated to the extent [illegible], then closure of the OB/OD facilities will be completed and post-closure care will be implemented.

In the event that post-closure monitoring is required, a Post-Closure Plan will be submitted to the NMED for review and approval. The Post-Closure Plan will address applicable requirements of 40 CFR 264.117 - 264.120, and the following elements, as appropriate:

- Institutional controls (e.g., fencing, signs, and deed notices (i.e., establishment and enforcement of property use)
- Inspection/site security
- Insect and rodent control
- Landscape maintenance
- Run-on/run-off and erosion control
- Monitoring
- Post-closure notices
- Certification for post-closure care completion

8.7 COST ESTIMATE FOR POST-CLOSURE CARE (40 CFR 264.144)

[illegible] is a federal facility. In the event that post-closure care is required, under 40 CFR 264.140 (c), the Federal government is exempt from the requirements of 40 CFR Subpart H - Financial Requirements.

8.8 FINANCIAL ASSURANCE FOR POST-CLOSURE CARE (40 CFR 264.145)

[illegible] is a federal facility. In the event that post-closure care is required, under 40 CFR 264.140 (c), the Federal government is exempt from the requirements of 40 CFR Subpart H - Financial Requirements.

9.0 REFERENCES

1. United States Army Environmental Hygiene Agency, Phase 3, Hazardous Waste Study No. 37-26-0147-84, "Summary of AMC Open-Burning/Open-Detonation Ground Evaluations", November 1981 - September 1983.

2. United States Army Environmental Hygiene Agency, Phase 5, Hazardous Waste Study No. 37-26-0593-86, "Summary of AMC Open-Burning/Open-Detonation Grounds Evaluations", March 1981 - March 1985.

3. United States Army Environmental Hygiene Agency, "RCRA Part B Permit Writer's Guidance Manual for Department of Defense Open-Burning/Open-Detonation Units".

4. United States Army Toxic and Hazardous Materials Agency (USATHAMA), "Master Environmental Plan: Fort Wingate Depot Activity, Gallup, New Mexico", December 1990, Prepared by: Environmental Assessment and Information Sciences Division, Argonne National Laboratory, Argonne, Illinois (CETHA-BC-CR-91007, ANL/EAIS/TM-37).

Appendix A
Excerpts from the Fort Wingate Depot Activity - RCRA Part B Permit Application, November 1988

- *Appendix II - Materials Historically Treated at FWDA*
- *Appendix III - Explosive Hazardous Constituents*
- *Table C-3, Explosive Wastes and ID Numbers and Booster and Secondary Explosives (High Explosives)*

APPENDIX II

MATERIALS HISTORICALLY TREATED AT FWDA

A. BLACK POWDER

A.1 General Description

Black powder is a low explosive, composed essentially of a mixture of potassium nitrate or sodium nitrate, charcoal, and sulphur. The proportions of ingredients are approximately 75 percent nitrate, 15 percent charcoal, and 10 percent sulphur. The Navy uses it in the form of grains or granules of varying sizes and degree of fineness, depending on its specific purpose or function. The grains are usually glazed and graphited to improve the power's resistance to moisture and to give it a low coefficient of friction so that the grains will slide one upon the other for more compact loading. Black powder, originally called gun powder, is the oldest of the explosive and one of the most dangerous.

A.2 Classes and Uses

The various classes of black powder and the primary uses of each are described below.

A.2.a. Black Powder (Potassium Nitrate)
Black powder with a potassium nitrate base is divided into the following classes:

Class 1. Used in JATO and rocket igniters, artillery primers and igniter pads.

Class 2. Used in JATO and rocket igniters, primers, and propelling charges for line-throwing rockets and cartridges.

Class 3. Used in JATO and rocket igniters, expelling charges for base ejection shells, and pyrotechnic items.

Class 4 and 5. Used in JATO and rocket igniters, relay pellets, igniting charges for illuminating pyrotechnics, charges in target practice shells, expelling charges for base ejection shells, and igniter charges in primer detonators, fuze delay elements, and tracer igniters.

Classes 6 and 7. Used in JATO and rocket igniters, relay pellets, and delay and igniter charges in primer detonators, delay elements, practice hand grenade fuzes, and Navy squibs.

Class 8. Used in propellant charges for rocket signals.

A.2.b. Black Powder (Sodium Nitrate)
Black powder with a sodium nitrate base is divided into the following classes:

Class A. Used in saluting charges

Class B. Used in practice bombs

Class C. Used in torpedo impulse charges.

B. HIGH EXPLOSIVES

B.1 General Description

The various types of high explosives which are commonly used and stored by the Navy are described in the following paragraphs:

B.1.a. Trinitrotoluene (TNT)
TNT is a light brown or white colored material whose appearance varies with the degree of purity. It is insoluble in water but soluble in ether, acetone, alcohol, and similar solvents. Although TNT is less sensitive to friction and impact than many other explosives, it can be detonated by moderate force when confined between metal surfaces such as on threads of bolts. In thin, unconfined layers it usually burns without explosion. Burning or rapid heating under confinement may cause detonation. TNT is stable and does not form sensitive compounds with metals. It will, however, become very sensitive in the presence of alkalies. TNT exhibits well recognized toxic properties.

B.1.b. Cyclotrimethylenetrinitramine (RDX)
RDX is a white crystalline solid usually used in mixtures with other explosives, oils, or waxes and is rarely used alone. It has a high degree of stability in storage and is considered the most powerful and brisant of the military high explosives.

B.1.c Explosive D.
Explosive D (ammonium picrate) is a high explosive usually derived by nitration of phenol followed by ammonification of the picric acid which is produced. In bulk density, explosive D appears in the form of finely divided crystals. Explosive D stains human hair and skin yellow, due to the yellow dye content in the picric acid. If not entirely free of traces of unammoniated picric acid, explosive D will react with certain metals such as lead, potassium, copper, and iron to form sensitive compounds and must, therefore, be protected from direct contact with these metals.

B.1.d. Pentaerythritol (PETN)
PETN is more sensitive than either tetryl or RDX. In its pure form, PETN is a white crystalline material, but it may be light gray in color due to impurities. It must be shipped wet with not less than 40 percent by weight of water in metal barrels or drums or wooden barrels or kegs in which the material is packed in cloth or rubber bags. It is extremely sensitive to initiation

and as such is considered an initiating agent.

B.1.e. Pentolite
Pentolite is a castable mixture of PETN and TNT usually in a 50/50 proportion. Pentolite may have a tendency to separate into its ingredients and, consequently, it should be handled as carefully as PETN.

B.1.f. N-tetranitro-N-methylaniline (Tetryl)
Tetryl is a fine yellow crystalline material which is insoluble in waster but soluble in acetone, benzene, and other similar solvents. It is toxic when taken internally or by skin contact and special precautions are necessary to protect personnel. It is stable at all temperatures normally encountered in storage.

B.1.g. RDX Composition
RDX compositions are mixtures of RDX, other explosive ingredients, and desensitizers or plasticizers. Three RDX compositions are described below:

(1) Composition A: During world war II the British introduced an explosive composition consisting of 91% RDX and 9% beeswax. This was designated as Composition A. When the United States standardized Composition A, the beeswax was replaced with wax derived from petroleum. Subsequent changes in the method of adding the desensitizer led to designation of the explosive as Composition A-2. More recently the composition has been designated as Composition A-3 because of later changes in the granulation of RDX and the method of manufacture. The wax is applied to coat the particles of RDX and act as a binding agent when the composition is pressed. Compositions A-4 and A-5 consisting of 97.0 and 98.5% RDX, respectively, with desensitizer added, have been developed but these explosives are not widely used.

(2) Composition B: This consists of castable mixtures of RDX and TNT; in some instances desensitizing agents are added to the mixture. The following are formulations of Composition B:

Composition B. 60% RDX and 40% TNT with 1% wax added.

Composition B-2. 60% RDX and 40% TNT

Composition B-3. Percentages of RDX and TNT vary but no desensitizer is added.

Composition B-4. 60% RDX, 39.5% TNT, and .5% Calcium Silicate.

Composition B, Desensitized. There are two formulations of desensitized Composition B--(1) 60% RDX and 40% TNT with 5% wax and 2% Vinylseal added, and (2) 55.2% RDX, 40% TNT, 1.2% Vistanex, and 3.6% Albacer Wax.

(3) Composition C. The Composition C explosives are plastic demolition explosives consisting of RDX, other explosives, plasticizers, and so forth. The following are formulations of Composition C: although C-3 and C-4 are the only formulations presently being used, C-1 and C-2 may still be encountered:

Composition C-1. 88.3% RDX and 11.7% nonexplosive oily plasticizer containing 0.6% lecithin.

Composition C-2. 78.7% RDX, 5.0% TNT, 12% DNT, 2.7% MNT, 0.6% NC, 1.0% Solvent.

Composition C-3. 77% RDX, 3% tetryl, 4% TNT, 10% DNT, 5% MNT, and 1% NC.

Composition C-4. 91% RDX, 2.1% Plyisobutylene, 1.6% Motor Oil, and 5.3% Sebacate.

B.1.h. Cyclotols.

The cyclotols were developed by the British between World Wars I and II and standardized in the United States early in World War II. Cyclotol is prepared by adding water-wet RDX to molten TNT in a steam-jacketed kettle at a temperature of 100° C. Some water is poured off and the heating and stirring are continued until all moisture is evaporated. The composition is cooled to a satisfactory pouring temperature. It is cast directly into ammunition components or in the form of chips when the cyclotol is to be stored for use later. There are three formulations of cyclotol being used, 75/25, 70/30, and 65/35 with the first number being the percent of RDX and the second number being the percent of TNT. Cyclotols used at NAVSEASYSCOM installations are procured commercially. Cyclotols are used for loading shaped-charge bombs, special fragmentation projectiles, and grenades.

B.1.i. Aluminized Explosives

Aluminum is added to explosives to increase its explosive power. Some recent studies to determine the optimum amount of aluminum for the TNT/aluminum mixture have shown that the blast effect reaches the maximum when the aluminum content is 30%. The brisance, as measured by the sand test, passes through a maximum of about 17% aluminum. The rate of detonation of cast charges is continuously decreased by addition of aluminum up to 40%. For all practical purposes, the addition of 18% to 20% of aluminum to TNT produces maximum performance of the TNT.

Six aluminized explosives are described in the following sections:

(1) HBX. HBX-1 and HBX-3 are binary explosives which were developed by the United States during World War II. The relatively insensitive mixtures were made by adding 5% desensitized to Torpex II for High Blast Explosive applications. They are castable mixtures of RDX, TNT, powdered aluminum, D-2 wax, and calcium chloride. The exact formulations are:

	Percent HBX-1	Percent HBX-3
RDX	40	31
TNT	38	29
Powdered Aluminum	17	35
D-2 Wax	5	5
Calcium Chloride (added)	0.5	0.5
Loading Density	1.69	1.69

HBX can be made by adding the calculated amount of TNT to Composition B to obtain the desired proportion of RDX/TNT. After the TNT/Comp B is melted, the appropriate amounts of the other ingredients are added to complete the mixture. HBX is used in guided missile warheads and underwater ordnance.

(3) Tritonal. This is a binary explosive developed by the United States during World War Ii. It is a castable mixture consisting of 80% TNT and 20% powdered aluminum. It is prepared by adding the TNT and aluminum separately to a steam-jacketed melt kettle equipped with an agitator. Heating is continued until the TNT is molten and the mixture is at the right viscosity for pouring (about 85° C). Tritonal is used as the bursting charge for general purpose bombs.

B.1.j. Composition D-2.
This is a desensitizing wax used in many of the high explosive mixtures which have been discussed in this section. Composition D-2 contains 84% paraffin and other waxes, 14% nitrocellulose, and 2% lecithin.

C. INITIATING EXPLOSIVES

C.1 General Description

Complete detonation is accomplished by adding an initiating device to the explosive. Detonating substances used for this purpose are initiating mixtures consisting of an initiating explosive (also known as a primary explosive), such as lead azide or lead styphnate, thoroughly mixed with other materials. These mixtures will detonate by the application of impact, friction, heat or electrical current and will impart a percussion blow suitable to detonate a high explosive. Initiating explosives detonate, whether they are confined or not. They differ considerably in sensitivity to heat, and the amount of heat they give off, and in brisance.

C.2 Types of Initiating Explosives

Types of initiating explosives commonly stored and used by the Navy are described in the following sections.

C.2.a Lead Azide

Lead azide is a crystalline, cream-colored compound which is practically insoluble in water. When lead azide is stored in water, however, care must be taken to assure that the water is free of bacteria forming impurities whcih may react with the dextrinated lead azide to form a gas. Lead azide shall not be exposed to copper, zinc, or alloys containing such metals because of the possible formation of other azides which are more sensitive than the original lead azide.

C.2.b Lead Styphnate

There are two forms of lead styphnate--that which appears as six-sided monohydrate crystals and that which appears as small rectangular crystals. Its color varies from yellow to brown. Lead styphnate is particularly sensitive to fire and the discharge of static electricity and, when dry, can be readily detonated by static discharges from the human body. The longer and narrower the crystals, the more susceptible the material is to static electricity. Lead styphnate does not react with metals and it is less sensitive to shock and friction than mercury fulminate or lead azide. Lead styphnate is only slightly soluble in water and methyl alcohol and may be neutralized by a solution of sodium carbonate.

C.2.c Tetracene

Tetracene is a colorless or pale yellow material. It is soluble in strong hydrochloric acid but practically insoluble in alcohol, water, benzene, ether, and carbon tetrachloride. It explodes readily from flame and produces a large volume of black smoke. It is lightly more sensitive to impact than mercury fulminate. Tetracene has the disadvantage of becoming easily dead-pressed.

D SMOKELESS POWDER

D.1 General Description

Smokeless powder is produced in many different types. Originally it was developed as a propellant for gun ammunition, and this remains a principle use today. In late years special types have developed as propellants for rockets and missiles. Smokeless powder is a hard, plastic substance, the color and appearance of which may vary from chalk white through pale yellow and translucent to black and completely opaque. Recently developed types are almost white and opaque.

D.2 Types by Characteristic of Base

Smokeless powder generally is considered to be of three types: single-base, double-base, and multibase. In single-base powder, nitrocellulose is the only explosive ingredient. Double-base powder contains both nitrocellulose and nitroglycerine as explosive ingredients. One multibase powder is cordite propellant which contains nitrocellulose, nitroglycerine, and nitroguanidine.

D.3 Types by Index Designation

Index numbers are given serially to powder that has been manufactured and proofed. The numbers aid in the identification of each index and also give an approximate indication as to the age of the powder. Each index of powder is assigned an index number consisting of a group of letters which designate the type of powder and a number which indicates the sequence of manufacture. Following are the index designation letters and their meanings. The letters SP refer to smokeless powder not containing stabilizers as distinguished from the earlier propellants, black powders, and brown powders (BP). SPR indicates a type of powder to which rosaniline dye was added to give it a violet color and to indicate that its stability was acceptable until the color changed to red by formation of decomposition acids within the grain. This procedure was not successful and the powder is no longer used. The letters D and C indicate the stabilizer diphenylamine and centralite, respectively.

D.3.a SPD

Smokeless powder stabilized by addition of diphenylamine. All powder since index 883 has been stabilized. This is standard "pyro" composition powder.

D.3.b SPDB

A blend of stabilized SPD smokeless powder. The blend was originally devised to provide an index of ample size for a ship's service allowance but the letters are now assigned to a lot made to utilize small remnants for service or target practice purposes. A blend of large-web and small-web powder may be made to produce an equivalent intermediate web to satisfy desired ballistics.

D.3.c <u>Nitrocellulose</u>
Nitrocellulose includes various types of nitrated cotton or wood pulp depending on the nitrogen content. Nitrocellulose when dry is extremely sensitive to shock and friction and readily accumulates static charges. It is highly flammable and explosive and burns rapidly but produces very little smoke and leaves no residue. When impure, it is subject to spontaneous ignition.

E. SOLID PROPELLANTS

E.1 General Description

Cast propellants are used normally in missiles and rockets of five-inch diameter and larger. Cast propellant grains are produced from both single-base and double-base casting powders.These casting powders are in granulation similar to small-arms powders but each has its own composition as follows:

E.1.a <u>Single-Base Powder</u>
In single-base powder, nitrocellulose forms the principal explosive ingredient. The nitrocellulose is transformed by a solvent into a colloid for granulation. Modifiers and stabilizers are included to obtain suitable form, desired burning characteristics, and stability. Single-base powder produces a larger volume of gas but less heat than double-base powder.

E.1.b <u>Double-Base Powder</u>
In characteristic double-base powder, nitroglycerine and nitrocellulose are the principal explosive ingredients. The nitrocellulose is transformed by the nitroglycerine and other added ingredients into a colloid for granulation.

F. GUN AMMUNITION

F.1 Projectiles

Projectiles are of various types and may be base fuzed, nose fuzed, or both. Commonly designated types are described in the following sections.

F.1.a <u>Loaded Projectiles</u>
These consist of all types of projectiles, 20-mm and larger caliber, which contain special materials or any of the following:

(1) Explosive in any form or quantity as a filler

(2) Pyrotechnic composition for illuminating, screening, signaling, or incendiary purposes.

(3) Smoke-making composition

APPENDIX III

EXPLOSIVE HAZARDOUS CONSTITUENTS

EXPLOSIVE CONSTITUENTS

Constituents	Cas No.	Method No.
Acetone	67-64-1	8270
*Acetyl Triethyl Citrate	----	----
*Aluminum Powder	----	----
*Ammonium Nitrate	----	----
Antimony	Total	6010/7040/7041
Barium	Total	6010/7080
*Boron	----	----
*Butyl Stearate	----	----
Cadmium	Total	6010/7130/7131
Chromium	Total	6010/7190/7191
*Diazodinitrophenol	----	----
Diethyl Phthalate	84-66-2	8060/8270
Dimethyl Phthalate	----	8060/8270
Di-n-butyl phthalate	84-74-2	8060/8270
Di-n-octyl phthalate	117-84-0	8060/8270
*Dichromated Aluminum Powder	----	----
2,4-Dinitrotoluene	121-14-2	8090/8270
2,6-Dinitrotoluene	----	8090/8270
Diphenylamine	122-39-4	8270
*Ethyl Centralite	----	----

EXPLOSIVE CONSTITUENTS
(Cont.)

Constituents	Cas No.	Method No.
*HMX	----	----
Lead	Total	6010/7420/7421
*Magnesium Powder	----	----
*Magnesium Alloy Powder	----	----
Nickel Powder	Total	6010
*Nitrocellulose	----	----
*Nitroglycerin	----	----
*Nitroguanidine	----	----
*Nitrostarch	----	----
*Pentolite	----	----
*Pentaerythritol tetranitrate (PETN)	----	----
*Phosphorous	----	----
*Potassium Nitrate	----	----
*RDX (Cyclonite)	----	----
*Resorcinol	----	----
Selenium	Total	6010/7740/7741
*Sodium Nitrate	----	----
*Strontium Nitrate	----	----
*Tetracene	----	----
*Tetryl	----	----
*Titanium Powder	----	----

EXPLOSIVE CONSTITUENTS
(Cont.)

Constituents	Cas No.	Method No.
*TNR (Trinitroresorcinol)	----	----
*TNT (Trinitotoluene)	----	----
*Tri Amino Guanidine Nitrate	----	----
Vinyl Acetate	108-05-4	8240/8240
Vinyl Chloride	75-01-4	8010/8240
Zinc	Total	6010/7950
*Zirconium Powder	----	----

* These constituents did not have a specified test method in "Summary of Appropriate Analytical Methods for Appendix 9". (USEPA, July 1987, PB87-230371)

ROCKET MOTOR PROPELLANT CONSTITUENTS

Constituent	Cas. No.	Method No.
*Ammonium Perchlorate	----	----
*Bis isopytahaloyl 1 (2 methyl) axiridicn	----	----
*Bisphenol - A/butyl glycidyl	----	----
*Boron Potassium Nitrate	----	----
*Di (2-ethylhexyl) sebarate	----	----
*Di (tridecyl) thiodi-propionate	----	----
*Dimeryl di-isocyanate	----	----
*Dioctyl adipate	----	----
*Diphenylbismuth	----	----
*HTPB (hydroxyl-terminated polybutadiene	----	----
*Isophorone di-isocyanate	----	----
*Maleic anhydride	----	----
*2.2' Methylene bis (u methyl 6 tert-butyl-phenol)	----	----
*N-normal butyldiethane-lamine	----	----
*PBAA (Poly (butadiene-acrylicacid	----	----
*Symdi-beta-napthyl-para-phenylenediamene	----	----

* These constituents did not have a specified test method in "Summary of Appropriate Analytical Methods for Appendix 9." (USEPA, July 1987, PB87-230371)

Table C-3

EXPLOSIVE WASTES AND ID NUMBERS

PROPELLANTS

Name	Chemical Formula	Hazardous Waste ID Number
Nitrocellulose	$C_{12}H_{16}(ONO_2)_4O_6$	D003
Nitroglycerin	$C_3H_5N_3O_9$	D003
Nitroguanidine	$CH_4N_4O_2$	D003

These three primary constituents can be used singularly or in various combinations along with metals, metallic salts, and organic polymer binders.

PRIMARY EXPLOSIVES

Name	Chemical Formula	Hazardous Waste ID Number
Lead azide	N_6Pb (71% Pb)	D003, D008
Mercury Fulminate	$C_2HgN_2O_2$ (7.05% Hg)	P065, D003, D009
Diazodinitrophenol (DDNP)	$C_6H_2N_4O_5$	D003
Lead styphnate	$C_6HN_3O_8Pb$ (44.2% Pb)	D003, D008
Tetracene	$C_{18}H_{12}$	D003
Potassium Dinitrobenzo-furoxane (KDNBF)	$C_6H_2N_4O_6K$	D003
Lead Mononitroresor-cinate (LMNR)	$C_6H_3NO_2Pb$ (57.5% Pb)	D003, D008

Primary Compositions - mixtures of primary explosives, fuels, oxidizers and binders.

Table C-3
(continued)

EXPLOSIVE WASTES AND ID NUMBERS

Name	Chemical Formula	Hazardous Waste ID Number
Fuels - Lead thiocyanate	$Pb(SCN)_2$ (64% Pb)	D008
Antimony sulfide	S_5Sb_2	D003
Calcium silicide	$CaSi_2$	D003, D001
Oxidizers - Potassium chlorate	$C1O_3K$	D003
Ammonium Perchlorate	NH_4CIO_4	D003
Barium Nitrate	N_2O_6Ba	D003, D005

Table C-3
(continued)

BOOSTER AND SECONDARY EXPLOSIVES (HIGH EXPLOSIVES)

Aliphatic Nitrate Esters

Name	Chemical Formula	Hazardous Waste ID Number
1,2,4-Butanetriol Trinitrate (BTN)	$C_4H_7N_3O_9$	D003
Diethyleneglycol Dinitrate (DEGN)	$C_4H_8N_2O_7$	D003
Nitroglycerine (NG)	$C_3H_5N_3O_9$	D003
Nitrostarch (NS)	$C_6H_{10}O_5NO_2$	D003
Pentaerythyritol Tetranitrate (PETN)	$C_5H_8N_4O_{12}$	D003
Triethylene Glycoldinitrate (TEGN)	$C_6H_{12}O_4N_2O_4$	D003
1,1,1-Trimethylo-lethane Trinitrate (TMETN)	$C_5H_9O_9N_3$	D003
Nitrocellulose (NC)	$C_{12}H_{16}(ONO_2)_4O_6$	D003

Table C-3
(continued)

BOOSTER AND SECONDARY EXPLOSIVES (HIGH EXPLOSIVES)

Nitramines

Name	Chemical Formula	Hazardous Waste ID Number
Cyclotetra-methylene - tetranitramine (HMX)	$C_4H_8N_8O_2$	D003
Cyclotrime-thylene - trinitramine (RDX)	$C_3H_6N_6O_6$	D003
Ethylenediamine Dinitrate (EDDN Haleite)	$C_2H_6N_4O_4$	D003
Nitroguanidine (NQ)	$CH_4N_4O_2$	D003
2,4,6-Trinitro-phenyl-methyl-nitramine (Tetryl)	$C_7H_5N_5O_8$	D003

Table C-3
(continued)

BOOSTER AND SECONDARY EXPLOSIVES (HIGH EXPLOSIVES)

Nitroaromatics

Name	Chemical Formula	Hazardous Waste ID Number
Ammonium pictrate (Explosive D)	$C_6H_3N_3O_7H_3N$	D003
1,3-Diamino-2,4,6-Trinitrobenzene (DATB)	$C_6H_4N_6O_6$	D003
2,2'4,4'6,6'-Hexanitroazobenzene (HNAB)	$C_{12}N_8O_{12}$	D003
Hexnitrostilbene (HNS)	$C_{14}H_2N_6O_{12}$	D003
1,3,5-Triamino-2,-4,6-Trinitrobenzene (TATB)	$C_6H_6N_6O_6$	D003
2,4,6-Trinitroluene (TNT)	$C_7H_5N_3O_6$	D003
Ammonium Nitrate	HN_4NO_3	D003

Compositions

Mixtures of the above

Plastic Bonded Explosive (PBX)

Explosives (see above) and polymer binder, plasticizer, and fuel (Aluminum or Iron)

Table C-3
(continued)

BOOSTER AND SECONDARY EXPLOSIVES (HIGH EXPLOSIVES)

Pyrotechnics

Combination of:

Oxidizer - oxygen or fluorine
Fuel - powdered Aluminum or Magnesium
Binding Agents - resins, waxes, plastics, oils, retardants, waterproofing, color intensifier

Specific propellant formulations which may be present on the various munitions/ordnance items thermally treated are summarized in Table C-3. Tables C-4 and C-5 depict typical PEP items which may be thermally treated via OB and OD respectively.

Appendix B
"Work Plan for UXO Support Services at Fort Wingate, New Mexico, November 1992"
Prepared By UXB International, Inc.

Revised January 1993

SUBMITTED TO:

ENVIRONMENTAL RESOURCES MANAGEMENT, INC.
855 SPRINGDALE DRIVE
EXTON, PENNSYLVANIA 19341

WORK PLAN

FOR
UXO SUPPORT SERVICES

AT
FORT WINGATE, NEW MEXICO

NOVEMBER, 1992

REVISED - JANUARY 1993

SUBMITTED BY:

UXB INTERNATIONAL, INC.
14800 CONFERENCE CENTER DR., SUITE 100
CHANTILLY, VA. 22021

1.0 INTRODUCTION

UXB International, Inc. is providing unexploded ordnance (UXO) support to Environmental Resources Management, Inc. during the installation of monitoring wells, soil borings, and sampling within the boundaries of Fort Wingate, New Mexico. UXB will also perform a UXO survey of Functional Test Ranges (FTR) Numbers 1, 2, and 3 and a surface survey of the current demolition and burning grounds. UXB will perform the following UXO related tasks at these designated sites:

a. Current Demolition and Burning Grounds - Perform a visual survey to determine the extent of kick-outs from the demolition pits. Assume a 25 yard safety margin past the most distant kick-out and map this perimeter using the Global Positioning System (GPS). Within this perimeter, perform a surface survey and removal of all ordnance debris. All live ordnance will be staged (if deemed safe to move) in an active demolition pit for final disposition by 41st Ordnance Detachment (EOD), Fort Bliss, TX. Ordnance which is too sensitive or dangerous to move will be marked for visual relocation and disposed of by 41st Ord Det (EOD). All ordnance debris which is recovered will be staged near the active demolition pits in a location designated by ERM. No sub-surface investigation or removal will occur inside the perimeter described above. Soil boring locations within the active demolition pits are saturated with metal debris which makes down-hole monitoring impossible. To ensure a UXO-free boring location, a test pit will be mechanically excavated down to undisturbed soil or soil void of metallic contacts, which ever comes first. The pit will be back filled with the original soil less any UXO removed and the site released to the drilling contractor.

b. Old Demolition and Burning Ground Sites - UXB will clear safety zones around each monitoring well and soil boring and access paths from established roads to the safety zone to allow safe entry and exit of equipment and personnel. Pre-clear each well and boring by performing down-hole monitoring for subsurface UXO to a depth of 12 feet or when undisturbed soil is reached (determined by ERM geologist).

c. Functional Test Range 1 - UXB will perform a surface survey (0" to 6") of FTR 1. This survey will use a combination of visual and geophysical survey methods. The Schonstedt GA52-B will be used to augment the visual survey by permitting inspection of vegetated areas without requiring brush clearance. All ordnance debris on the surface will be collected and staged near the active demolition pits in a location designated by ERM. All metallic contacts will be marked and excavated to a depth of 6 inches. All live ordnance found will be staged (if deemed safe to move) in an active demolition pit for final disposition by the 41st Ord Det (EOD). Ordnance which is too sensitive or dangerous to move will be marked for visual relocation and disposed of by 41st Ord Det (EOD). All contacts below 6 inches will be logged by latitude and longitude using the GPS and become part of the list of uncharacterized contacts contained in the final report. Distinguishable debris piles which are listed in the site description will be left in place and their surface layers visually surveyed for suspected live ordnance items.

d. Functional Test Range 2 - UXB will perform a surface survey (0" to 6") of FTR 2. This survey will use a combination of visual and geophysical survey methods. The Schonstedt GA52-B will be used to augment the visual survey by permitting inspection of vegetated areas without requiring brush clearance. All ordnance debris on the surface will be collected and staged near the active demolition pits in a location designated by ERM. All metallic contacts will be marked and excavated to a depth of 6 inches. All live ordnance found will be staged (if deemed safe to move) in an active demolition pit for final disposition by the 41st Ord Det (EOD). Ordnance which is too sensitive or dangerous to move will be marked for visual relocation and disposed of by the 41st ORD Det (EOD). All contacts below 6 inches will be logged by latitude and longitude using the GPS and become part of the list of uncharacterized contacts contained in the final report.

c. Functional Test Range 3 - UXB will perform a surface survey (0" to 6") of FTR 3. This survey will use a combination of visual and geophysical survey methods. The Schonstedt GA52-B will be used to augment the visual survey by permitting inspection of vegetated areas without requiring brush clearance. All ordnance debris on the surface will be collected and staged near the active demolition pits in a location designated by ERM. All metallic contacts will be marked and excavated to a depth of 6 inches. All live ordnance found will be staged (if deemed safe to move) in an active demolition pit for final disposition by the 41st ORD Det (EOD). Ordnance which is too sensitive or dangerous to move will be marked for visual relocation and disposed of by the 41st EOD DET (EOD). All contacts below 6 inches will be logged by latitude and longitude using the GPS and become part of the list of uncharacterized contacts contained in the final report.

UXB personnel will follow the general guidance contained in the Sampling Design Plan, Work Plan and Safety Plan prepared for the project by Environmental Resources Management and approved by USATHAMA. The information in this UXO Work Plan is intended to guide UXB personnel in the safe and efficient performance of their operations. Any conflicts between this work plan and any other documents governing the performance of field operations at Fort Wingate will be rectified by the ERM and UXB Project Managers.

UXB personnel will be specifically guided by the Standard Operating Procedures (SOP's) for conducting geophysical surveys, manual excavation of contacts, and down-hole monitoring that are included as a separate section of the UXO work plan.

UXB team assigned to the project can perform concurrent field operations. The minimum number of personnel assigned to perform an intrusive UXO task will be two qualified UXO Technicians. UXO escort and UXO detection\marking can be done by a single UXO Technician as long as radio communications between the concurrent operations can be maintained.

1.1 PERSONNEL ASSIGNMENTS

PROJECT MANAGER - Tom Yancey will serve as UXB Project Manager and have overall responsibility for UXB personnel and their performance. His presence will not be required on site except in the event of unforseen difficulties, or at the request of the ERM Field Operations Leader.

PROJECT LEADER - Bob Diekmann will be the UXB Project Leader and will be on site for the duration of UXB's field operations at Fort Wingate. He will be responsible for the safety of assigned personnel and the efficient performance of all daily field operations involving UXO and will assist ERM in any other field work requested. The Project Leader will also act as the UXB Quality Control Coordinator and perform percentage and random QC checks on sweep line operations and UXO excavations.

UXO SPECIALISTS - will be responsible for supervising the ordnance sweep lines and excavation teams. They will assist the Project Leader in other duties such as UXO Safety Escort and marking safe perimeters around the rocket motor burials. The UXO Specialists will be selected from the following list of UXB employees, all meeting the UXO contractor qualifications specified by USATHAMA in the scope of work:

W. Whitten	P. Kirwan	B. Moe
J. Thoren	G. Cole	G. Childers
R. Wilson	C. Post	L. Dickson
C. Galbreath	M. Cooper	D. Randall
G. Payne	N. Doguet	S. Eanes

D. Isbell	J. Foster	D. Miller
J. Kerr	J. Booker	S. Brown

UXO TECHNICIANS - will be responsible for safely conducting UXO field operations such as UXO Safety Escort, Sweep Line members, Excavation Team members, well and boring site clearance, down-hole monitoring, and equipment maintenance as assigned by, and under the supervision of, the Project Leader. The UXO Technicians will also be selected from the list above.

LOCALLY HIRED LABORERS - UXB will interview laborers with an explosive safety background from the following categories who may be residing in the Gallup, NM area:

a. Former Fort Wingate ordnance workers.
b. Former military personnel with ordnance experience.
c. Former mining industry personnel who have worked as blasters or blasters' helpers.

UXB will verify this experience through documentation such as DD Form 214, Civil Service personnel performance records, or state blasting licenses. UXB will also provide instruction on basic explosive safety as a refresher. This instruction will cover:

a. Explosives Safety Precautions.
b. Ordnance Safety Precautions.
c. Recognition of explosives and ordnance after exposure to weathering and erosion.

In addition to basic explosive safety, UXB will provide training in:

a. Schonstedt GA52-B locator operation.
b. Sweep-line procedures.
c. Site orientation which will include an ordnance identification line consisting of ordnance items found to date.
d. Basic ordnance identification and hazard recognition.
e. UXB SOP for Geophysical Surveys at Fort Wingate, NM.

These locally hired employees may be used in logistical support of the FTR surveys, but **will not**:

a. Handle any ordnance item until it has been inspected by a UXB UXO Specialist and determined to be inert.
b. Perform any excavation of subsurface contacts.
c. Perform any functions in the current demo/burn area.
d. Perform as a sweep-line member until the above training has been received.

The UXB Project Leader will monitor the locally hired employees for any drug or alcohol intoxication at the start of each work day. Any employee suspected of drug or alcohol intoxication will be dismissed permanently.

If local labor of adequate qualifications is not available, UXB personnel will be used to the extent necessary to perform all tasks in absolute safety.

1.2 EQUIPMENT

The following major equipment items will be required to provide UXO services in support of the field activities at Fort Wingate, New Mexico:

EQUIPMENT	QUANTITY
GEOPHYSICAL EQUIPMENT	
White's Eagle II Metal Detector	3
Foerster Ferex Ordnance Locator	3
Schonstedt Model GA-52B	15
SUPPORT EQUIPMENT	
Generator	1
High Cube Van	1
Back-hoe	TBD
Motorola HT-90 Portable Radios	5
General Support Tool Kit	1
Excavation Tool Kit	1
GPS	1
Computer	1
EMT kit	1
Mobile phone	1

2.0 TECHNICAL APPROACH

All of the tasks described in section 1.0 consist of the following UXO operations:

a. SURFACE SURVEY - Using magnetometers or metal detectors to augment a visual examination of the surface to a depth of six inches in a non-intrusive manner.

b. EXCAVATION - Using hand excavation tools to expose subsurface contacts for identification as UXO or non-UXO for characterization of the contamination present.

c. DOWN-HOLE MONITORING - Using the Foerster Magnetometer reconfigured to the underwater mode to check hand-augered boreholes for subsurface ferrous contacts. When performing down-hole magnetometry surveys during drilling /boring operations in suspect or known unexploded ordnance areas, measurements must be taken at intervals of every 4 feet.

The decision to perform down-hole magnetometry at intervals other than every 4 feet must be justified by a site specific analysis which supports the need. Prior to each measurement, the drill rig and equipment (augers) must be "backed off" the hole to a distance of approximately 20 feet to eliminate interference to the magnetometry equipment. To reduce the hazard to personnel due to moving the rig/equipment, only the minimum number of moves necessary to accomplish UXO clearance will be performed. In this specific case, hand augering in the OB/OD area every two feet is acceptable.

The survey methods described above will be used to conduct the UXO portions of the field activities. A more detailed explanation of the UXO techniques follows.

2.1 GEOPHYSICAL SURVEY

USATHAMA requires that two distinct methods of geophysical survey be conducted. The Foerster Ferex Ordnance Locator will be used, in conjunction with the White's commercial metal detector, for all subsurface geophysical surveys. The following are descriptions of these two electronic detectors:

a. Foerster Ferex Electromagnetic Detector - The Foerster Ferex Ordnance Locator is the most recent military approved locator and is in use by the U.S. Military EOD forces, designated the MK 26 Ordnance Locator, for detecting subsurface ordnance items. The locator is a hand-held unit and uses 2 fluxgate magnetometers, aligned and mounted a fixed distance apart to detect changes in the earth's ambient magnetic field caused by ferrous metal or disturbances caused by soil conditions. Both an audio and metered signal are provided to the operator. The metered signal indicates whether the disturbance is geodetic or metal-related. The detection capability of the Foerster Ferex is dependent on the size of the item versus its depth. The Foerster Ferex is capable of ordnance location to the following depths:

ITEM	DEPTH
Small Arms Round	1 ft
Hand Grenade	2 ft
Anti-Personnel Mine	3 ft
Anti-Tank Mine	4.5 ft
Medium Projectile	10 ft
Small Bomb	15 ft
Large Bomb	19 ft

Although the Foerster Ferex Ordnance Locator will detect disturbances caused by changes in soil conditions, its ability to detect metallic items is not affected by local soil conditions because it is nulled to accept local soil conditions as normal background readings on-site.

b. WHITE'S EAGLE II METAL DETECTOR - A man-carried, microprocessor controlled metal detector with a Liquid Crystal Display and a keypad user interface. This metal detector operates on the induction principle whereby a transmitter coil induces eddy currents within buried metal and these induced eddy currents are received by a receiver unit. The advantage of this detector is that it can detect both ferrous and non-ferrous metals.

The instruments detailed above will be used, during the investigation, to locate subsurface metallic objects. They are very effective in areas where there is sparse metallic contamination and, conversely, of limited usefulness in areas that are heavily saturated with miscellaneous metallic debris and slag.

2.1.1 GEOPHYSICAL SURVEY PROCEDURES

The area to be surveyed is identified and its perimeter is marked with wooden stakes. This search area is then divided into search lanes two meters apart using surveyor's line. The ordnance locator operator walks the lanes using the ordnance locator to survey the entire area within each lane and marks all metallic contacts with a marker flag or spray paint for possible further inspection by excavation. A visual survey of the entire search area is conducted simultaneously.

2.2 EXCAVATION

The only way to positively identify a contact located during a geophysical survey is by excavation. UXB will use excavation under the following circumstance:

WHERE INDICATED BY THE GEOPHYSICAL SURVEY - In the case of site clearance to ensure the safety of well drilling personnel operating in the area, all potential UXO contacts will be carefully hand excavated and identified to a depth of two feet.

Any subsurface contacts found deeper than 2 feet at the drilling point for a well or boring will cause the drilling point to be relocated a minimum of 10 feet. The new location will be determined by the ERM Field Operations Leader with recommendations by UXB for clear areas. Please refer to paragraph 2.0, c.

2.2.1 METHOD OF EXCAVATION

HAND EXCAVATION - UXO Technicians will use hand tools to carefully remove soil and debris to uncover a known metallic contact located during the geophysical survey. The purpose of hand excavation is to identify a single previously located metallic contact.

2.2.2 EXCAVATION EQUIPMENT

The following type of excavation equipment will be used during excavation operations at Fort Wingate:

a. HAND TOOLS - Beryllium and stainless steel shovels, spades and trowels.

b. MECHANIZED EXCAVATOR - A back-hoe may be used to clear boring sites in the current demolition area when the sites are located within the demo pit or berm. The bucket path will be monitored by a safety observer visually and geophysically as the bucket skims no more than 6 inches of soil per pass.

3.0 OPERATIONAL PROCEDURES

3.1 GEOPHYSICAL SURVEY PROCEDURES

a. ESTABLISH THE COMMAND POST - A command post (CP) will always be established whenever field operations are being conducted in more that one location. The purpose of the CP is to allow a responsible person, who is familiar with on-site operations, to be present and to take appropriate action in case of an emergency at the work site. The person manning the CP will have communications with the field crews and outside assistance (fire dept., ambulance, base security, etc.) at all times. The CP will be the UXB mobile laboratory and will provide shelter, office space, and equipment storage at the work site. The CP has a permanently installed generator, lighting system and will have first aid equipment, eye wash station, potable water and a heating and cooling system.

b. ESTABLISH THE SURVEY AREA - Prior to conducting the geophysical survey, the area to be surveyed must be accurately established. Field crews will use the base maps provided by ERM and U. S. G. S. topographic maps to locate the desired survey area. The survey grids will be marked with wooden stakes and flagging tape. Existing boundaries such as fence lines, roads, and arroyos will be used to ensure all areas are 100 % searched with a slight overlap of the search areas. If the survey area is to be further divided into search lanes, these will be established and marked prior to beginning survey operations.

c. CONDUCT THE SURVEY - The geophysical survey team will consist of two teams of five UXB UXO Technicians. Each technician will carry a Schonstedt GA52-B locator and the sweep team leader will carry a Foerster Ferex Ordnance Locator. The team will search the predetermined lanes and record all contacts on their field site map. All positive contacts will be marked with a marking flag or spray paint to facilitate relocating the contact for excavation. A visual survey will take place simultaneously with the geophysical survey. Areas with vegetation will require a slower pace to allow probing of the brush with the GA52-B probe.

3.2 EXCAVATION

a. DETERMINE THE APPROPRIATE EXCAVATION METHOD - UXB will use the following criteria to determine the excavation method to be used:

1. HAND EXCAVATION - To be used for isolated contacts located during a geophysical survey that are suspected to be within six inches of the surface.

2. MECHANIZED EXCAVATION - Will not be required at any of the area survey sites, but may be selected for clearance of boring sites within the current demolition area.

3.2.1 HAND EXCAVATION PROCEDURES

A team of at least two UXB Technicians will approach the excavation site with suitable hand tools and the ordnance locator best able to detect the metallic contact to be excavated. Upon arrival at the marked contact, the contact will be reestablished using the ordnance locator and one technician will then carefully begin to excavate. The other UXB/UXO Technician will man the ordnance locator and frequently resurvey the contact to estimate its depth below the soil cover. When the object is located, it will carefully be uncovered, identified, and recorded. If the object is inert ordnance, small arms ammunition, or expended ordnance it will be moved to a designated nearby holding area for later disposition. If the item is UXO, the 41st ORD Det (EOD) will be notified for final disposition. No further work will be performed in this specific access lane or drill site safety radius until the UXO has been removed.

3.3 DOWN-HOLE GEOPHYSICS

A team of at least two UXB Technicians will pre-clear each monitoring well and soil boring point of subsurface UXO by hand-augering down to a depth of 2 feet. The hand auger will be retracted and the Foerster Ferex Ordnance locator, reconfigured to the underwater mode, will be slowly lowered to the bottom of the hole and the indicator dial allowed to stabilize. A check for subsurface ferrous objects will be made on each sensitivity scale. If no ferrous objects are indicated, the Foerster probe will be retracted and hand-augering will continue another 2 feet. This procedure will continue at 2 foot intervals until a depth of 10 feet or undisturbed soil is reached. At this depth, the final borehole check with the Foerster will clear the borehole to a depth of 12 feet. **Note**: If a subsurface ferrous object is detected, the well or boring must be relocated a minimum of 10 feet. Please refer to paragraph 2.0, c..

This procedure pre-clears the monitoring well and soil boring sites which allows the drill rig and soil samplers to operate independently of the UXO clearance team. The drill rig **MUST DRILL WITHIN ONE FOOT** of the pre-cleared, hand-augered hole to be assured of an auger path clear of UXO. Note: Drilling crew and samplers in the current OB/OD area will be accompanied by a UXB UXO Safety Escort or down-hole magnetometry team at all times.

Hand-augering may be assisted through the first four feet of dry, hard packed soil by a gasoline powered auger.

SECTION I

ORDNANCE SAFETY PRECAUTIONS

Ordnance Safety Precautions

REVISED - JANUARY 1993

Ft. Wingate

There is no "safe" procedure for dealing with UXO, merely procedures which are considered less dangerous. However, maximum safety in any UXO operation can be achieved through adherence to applicable safety precautions, a preplanned approach and intensive supervision.. Plans shall be based upon the minimum number of personnel, for a minimum amount of time, to the minimum amount of UXO consistent with efficient operations and maximum safety. Only those personnel absolutely necessary to the operation shall be allowed in the exclusion zone during UXO activities (DoD 6055.9-STD). **Only personnel who have graduated from the US Naval EOD school, Indian Head, MD are authorized to handle UXO.**

I. Proper precautions must be observed in searching for, probing for, excavating, moving, and handling UXO.

II. All UXO disposals will be accomplished by the 41st Ordnance Detachment (EOD). No UXO shall be destroyed unit is has been positively identified.

A. Make every effort to identify the UXO. Carefully examine the item for markings and other identifying features such as shape, size, and external fitting. However, do not move the item to inspect it. If an unknown UXO is encountered, photographs shall be taken and mailed to the 41st Ord Det (EOD), which has access to the TM 60-Series publications.

B. Foreign UXO were returned to the United States for exploitation and disposal. Records search should indicate the possibility of foreign UXO being on the site.

C. If the records search indicates UXO containing military toxic chemical agents may be on the site, a decontamination plan shall be approved prior to entry onto the site.

1. Any time a suspected chemical UXO in encountered, the 2-man concept is immediately implemented and notification shall be made through proper channels. The UXO shall be secured until the military arrives and assumes responsibility.

2. Provide a designated emergency vehicle in the area in case of an accident or other emergency.

III. Do not depress plungers, turn vanes, or rotate spindles, levers, setting rings, or other external fittings on the UXO. Such action may arm, actuate, or function the UXO.

A. Do not dismantle, strip or subject any UXO to unnecessary movement, except in response to a valid requirement.

B. Before any movement of an UXO, the fuze condition must be ascertained. If the condition is questionable, consider the fuze armed. The fuze is considered the most hazardous component of UXO, regardless of type or condition.

1. In general, the conditions of a BD fuze in an unexploded projectile cannot be determined through examination of its external features. When there is evidence that the projectile has been fired, the BD fuze is considered to be in the armed condition.

2. Arming wires and pop-out pins on unarmed fuzes should be secured by taping in place prior to movement.

C. Perform any initial movement of an armed fuze remotely and avoid any unnecesssary movement of an armed fuze.

D. When transporting a possible armed fuze, position the fuze in the most neutral orientation possible.

E. Do not subject a mechanical time fuze to any unnecessary movement.

F. Do not unscrew a fuze from a fuze well that does not contain a fuze cavity liner. High explosives may be on the threads.

IV. Do not allow unauthorized or unnecessary personnel to be present in the vicinity of UXO. Limit personnel exposure time. Operations shall always be based upon minimum exposure consistent with efficient operations.

V. Do not rely on the color coding of UXO for positive identification of contents. Munitions having none, incomplete, or improper color coding have been encountered.

VI. Avoid the area forward of the nose of a munition until it can be determined that the item is not a shaped charge and High Explosive Anti-tank (HEAT) UXO. The explosive jet can be fatal to great distances forward of the longitudinal axis of the item.

A. Assume any shaped charge munition to contain a piezoelectric (PZ) fuzing system until the fuzing is otherwise identified. A PZ fuze is extremely sensitive, can fire at the slightest physical change, and may remain hazardous for an indefinite period of time.

VII. Examine a projectile for the presence or absence of an unfired tracer.

VIII. Perform initial movement of an embedded projectile remotely. First movement of an embedded projectile may cause fuze functioning. During this remote operation, precaution shall be taken for a high-order detonation.

IX. Bury any incendiary ordnance in wet sand while transporting. This will smother any fire which could start until other corrective action can be taken. Do not transport a WP munition, unless it is immersed in water, mud or wet sand. If loose pyrotechnic, tracer, flare and similar mixtures are to be transported, they shall be placed in #10 mineral motor oil or equivalent to minimize the fire and explosion hazard.

A. Extra care shall be taken when uncovering a buried UXO, if records search indicated WP munitions were fired or destroyed in the area. A buried WP munition may be damaged and when exposed to air, may start burning and detonate. An ample supply of water and mud shall be immediately available if excavation reveals a WP UXO. Appropriate protective equipment (leather gloves, face shield, and flame-retardant clothing) and first aid shall also be immediately available.

X. Approach an unfired rocket motor from the side. Ignition will create a missile hazard and hot exhaust.

A. Do not expose electrically fired rocket motors within 25 feet of any exposed electronic transmitting equipment or exposed antennae leads.

B. If an unfired rocket motor must be transported it shall be positioned in the direction which offers the least exposure to personnel in the event of an accidental ignition.

XI. Consider an emplaced landmine armed until proven otherwise. It may not be possible to tell, or it may be intentionally rigged to deceive.

A. Many training mines contain firing indicator charges capable of inflicting serious injury.

B. Exercise care with wooden mines that have been buried for a long time. Because of soil conditions, the wood deteriorates and the slightest inadvertent pressure on top may initiate the fuze.

XII. The usual method for uncovering buried UXO is to excavate by hand. Hand excavation is the most reliable method for uncovering UXO, but unless the UXO is very near the surface, hand excavation exposes more people to the hazard of detonation for a longer period of time than any other method.

A. Earth moving machinery (EMM) may be used to excavate for buried UXO, if the UXO is estimated to be deeper than 12 inches. EMM shall not be used to excavate within 12 inches of an UXO. When excavation gets within 12 inches of a UXO, hand excavation shall be used to uncover the UXO.

1. If more than one EMM will be used on the same site, they will be separated by at least 100 meters during excavation.

2. During excavation operations, only those personnel absolutely necessary for the operation shall be within the exclusion zone.

B. Excavation shall comply with the provision of 29 CFR 1926 subpart P.

XIII. The site shall be surveyed for electromagnetic radiation (EM) radio frequency (RF) transmitters and appropriate action taken. Safe distances have been established for specific transmitter power and transmitters.

XIV. Do not wear outer or undergarments made of wool, silk, or synthetic textiles such as rayon and nylon while working on UXO. These materials can generate sufficient static charge to ignite fuels or initiate explosives. Any person coming in contact with a UXO, shall ground himself prior to touching EEDs. This must be done to discharge any electrostatic charge accumulation from the body.

XV. Personnel working with UXO or explosives shall comply with the following:

A: Do not carry fire or spark-producing devices on site.

B. Do not smoke, except in authorized area.

C. Do not have fires for heating or cooking, except in authorized area.

D. Do not conduct operations without approved Standing Operations Procedures (SOP) and proper supervision.

E. Do not become careless by reason of familiarity with ammunition.

F. Do not conduct UXO operations during electrical, sand, dust or snow storms.

G. Do not conduct UXO operations between sunset and dawn.

XVI. Civil War projectiles shall be treated as any other UXO, especially projectiles with uncut Bormann time fuses and projectiles with percussion fuzes, brass in particular. These have generally provided a water-tight seal, even if they have been in the ground over one-hundred years. No projectile should be exposed to excess heat, the ignition point of black powder, used as a bursting charge in all Civil War projectiles is 457 degrees F. Under no circumstances should an attempt be made to drill a hole in a projectile, either through the fuze or the body of the projectile.

XVII. If base-ejection type projectiles must be transported to a staging area or disposal area, the base shall be oriented to the rear of the vehicle and the projectile secured, in the event the ejection charge functions in route.

XVIII. If a UXO with exposed hazardous filler has to be transported to a disposal site, the item shall be placed in a heavy duty plastic bag to prevent migration of the hazardous filler. Padding should also be added to protect the exposed filler from heat, shock, and friction.

XIV. 29 CFR 1926.100 requires personnel to wear protective helmets in areas where there is a possible danger of head injury form impact, or from falling or flying objects, or from electrical shock or burns. During field activities on ordnance projects, hardhats need not be worn unless a head injury threat is present.

XV. Soil samples, test pit excavation, and/or monitoring well installation are sometimes conducted in areas where subsurface UXO may be found. These intrusive activities must be preceded by a magnetometer survey to assure the safety of the sampling crews.

A. Prior to the drilling rig coming on site, a magnetometer and a hand-held auger shall be utilized to assure the drilling spot is clear of subsurface UXO.

(1) After finding an area the magnetometer indicates is clear of detectable UXO, the hand-held auger should be used to start the drill hole. At not more than 2 feet deep the hand-held auger shall be withdrawn and the magnetometer probe shall be lowered into the auger hole. This procedure will ensure small UXO items (20 mm projectiles and grenades), undetectable from the surface, are now detectable. This procedure shall be repeated until the maximum depth of the hand-held auger is reached.

(2) Borehole monitoring shall continue at 4 foot intervals until undisturbed soil is encountered.

SECTION II

STANDING OPERATING PROCEDURES

APPENDIX A

STANDING OPERATING PROCEDURES

GEOPHYSICAL UXO SURVEY

OF

FUNCTIONAL TEST RANGES 1,2,3, AND CURRENT DEMO/BURN AREA

FORT WINGATE, NM

STANDING OPERATING PROCEDURES (SOP) FOR GEOPHYSICAL UXO SURVEYS FORT WINGATE FUNCTIONAL TEST RANGES AND DEMO/BURNING GROUNDS

STEP DESCRIPTION		SPECIFIC INSTRUCTIONS
1.	Daily Operations	a. All personnel report to the work site at time designated by the Senior UXO Specialist.
		b. The Senior UXO Specialist will give the daily safety briefing to all site workers and give specific instructions for the day's work.
		c. The project command post (CP) will be designated and all personnel not directly involved in down-range operations will remain at the CP. Visitors requesting to observe down-range operations will be escorted by the Senior UXO Specialist or his representative.
		d. Communications with down-range personnel are mandatory. Radios will be tested prior to beginning UXO operations.
		e. A minimum of two qualified UXO Technicians will be onsite during all UXO operations.
		f. The Senior UXO Specialist will maintain a log detailing all field operations in accordance with direction contained in the work plan.
2.	Geophysical Survey Procedures	a. The UXO Supervisor will verify and survey area.
		b. The UXB survey crew, consisting of a minimum of two UXO Technicians, will conduct a visual inspection of the survey area to locate any obvious surface UXO hazards.
		c. The survey area will be divided into six-foot-wide search lanes using wooden stakes and surveyor's line to clearly mark the lanes.
		d. The geophysical instruments to be used to conduct the survey will be assembled and operationally checked in the CP area, by testing the instrument response to known objects buried at known depths, prior beginning the geophysical survey.
		f. All subsurface metallic contracts will be marked with pin flags.
3.	UXO Disposal	a. All confirmed UXO will be identified, recorded, and the 41st Ordnance Detachment (EOD) notified of their location, condition, and quantity for disposal.

4.	Post-Operation Procedures	a. The Senior UXO Specialist will ensure all equipment is properly stored and secured. Important: Loosen swivel screws on Foerster Ferex before folding probe. b. The Senior UXO Specialist will conduct a daily debrief of the project and briefly outline the next day's objectives. c. Prior to departing the work site the Senior UXO Specialist will ensure that the project area is clean and free of UXO and industrial hazards.

APPENDIX B

STANDING OPERATING PROCEDURES

UXO SAFETY ESCORT

FORT WINGATE, NM

STANDING OPERATING PROCEDURES (S0P) FOR GEOPHYSICAL ESCORT FORT WINGATE, NEW MEXICO

STEP DESCRIPTION		SPECIFIC INSTRUCTIONS
1.	Daily Operations	a. All personnel report to the work site at time designated by the Senior UXO Specialist.
		b. The Senior UXO Specialist will give the daily safety briefing to all site workers and give specific instructions for the day's work.
		c. The project command post (CP) will be designated and all personnel not directly involved in down-range operations will remain at the CP.
		d. Communications with down-range personnel are mandatory. Radios will be tested prior to beginning UXO operations.
		e. A minimum of two qualified UXO Technicians will be on site during all UXO operations.
		f. The Senior UXO Specialist will maintain a log detailing all field operations in accordance with direction contained in the work plan.
2.	Geophysical Survey Procedures	a. One UXO Technician will survey the area to be traversed ahead of the samplers and mark ordnance items (both surface and subsurface with biodegradable spray paint or pin flags. These marked areas will be avoided during this and subsequent passage.
		b. Any UXO located is to be left in place and reported to the 41st Ordnance Detachment (EOD) for final disposal.
		c. Areas such as demolition ranges, disposal burn sites, or landfills containing ordnance, will require a UXO Technician to accompany non-ordnance personnel during each excursion within the site boundaries.
		d. Cleared areas will be re-inspected after excavations, heavy rains, or any other terrain-altering disturbances which may

have uncovered ordnance.

e. Any area deemed to be too heavily contaminated with ordnance or explosive waste by the Senior UXO Supervisor to allow non-ordnance personnel to enter for sampling or other activities may require the activities to be performed by a UXO Technician under the instruction of the sampler.

APPENDIX C

STANDING OPERATING PROCEDURES

DOWN-HOLE MONITORING

FORT WINGATE, NM

STANDING OPERATING PROCEDURES (SOP) FOR
DOWNHOLE GEOPHYSICS
FORT WINGATE, NM

STEP DESCRIPTION	SPECIFIC INSTRUCTIONS
1. Daily Operations	a. All personnel report to the work site at time designated by the Senior UXO Specialist. b. The Senior UXO Specialist will give the daily safety briefing to all site workers and give specific instructions for the day's work. c. The project command post (CP) will be designated and all personnel not involved in down-range operations will remain at the CP. d. Communications with down-range personnel are mandatory. Radios will be tested prior to beginning UXO operations. e. The Senior UXO Specialist will maintain a log detailing all field operations in accordance with direction contained in the work plan.
2. Downhole Geophysics Procedures	a. Proposed monitoring well sites will be reviewed with prime contractor for position, physical obstacles, and access paths. b. Selected drilling sites will be marked with stakes and flagging tape to identify the cleared radius. Radii will be based on size of drill rig as follows: Minimum............15 feet 1 ton rig..........30 feet 5 ton rig..........45 feet 10 ton rig.........60 feet c. The safety radii will be surveyed with the Foerster Ferex Ordnance Locator and the White's Eagle II detector to a depth of two feet. All metallic contacts will be marked for avoidance or excavated and identified (contract specific).

d. A 15 foot wide access path from the nearest road to the well site will be marked with stakes and flagging and cleared in the same manner as the safety radius. The stakes will be of sufficient height to be visible to the drill rig driver as he maneuvers from the road to the drill site.

e. A UXO located which is unsafe to move will be left in place and reported to the 41st Ordnance Detachment (EOD) for disposal.

f. A UXO Technician will hand auger down two feet at the proposed well site. With the Foerster configured in the underwater mode, the probe will be lowered to the bottom of the hole and monitored for metallic contacts. At this point, the well site will be cleared to a depth of four feet. Refer to paragraph 2.0, c. of the UXO Work Plan.

g. Position the drill rig upwind of well site. Observe drilling progress to a depth of four feet (Note: To facilitate sampling in undisturbed soil, the drill rig auger can offset to within one foot of the hand-augered hole and still be assured of a UXO-free path).

h. Instruct the drillers to cease drilling and remove the first four feet of hollow-stem auger from hole.

i. Insert 4" diameter PVC pipe in open hole to prevent cave-in (if required by soil conditions).

j. Lower Foerster Ferex probe into the PVC pipe to the bottom of the hole and recalibrate the instrument for full range investigation using each mode and scale. If instrument readings are negative, drilling may continue. If a ferrous contact is indicated, relocate the well a minimum of ten feet from original location.

k. Repeat step i. until cleared to the depth of concern. Refer to paragraph 2.0, c. of the UXO Work Plan.

l. If drilling operations are to be performed at a later date, the borehole may be entirely cleared down to 20 feet (if soil conditions permit) by hand-auger and the Foerster Ferex. The drill rig MUST auger within one foot of the pre-cleared hole to be assured that no ferrous objects will be encountered.

Appendix C
Excerpts from the "Master Environmental Plan, Fort Wingate Depot Activity, Gallup, New Mexico", December 1990, USATHAMA, Prepared by: Environmental Assessment and Information Sciences Division, Argonne National Laboratory, Argonne, Illinois.

- *Subsection 4.4 Demolition and Burning Area, pages 87 - 98.*

Based on the results of the second phase, the need for further action should be determined.

4.4 DEMOLITION AND BURNING AREA

In the west central portion of FWDA property, there are approximately 1,100 acres (close to 5% of the installation ground) fenced and designated as the Demolition and Burning Area (Figs. 2.3 and 4.14). This area contains several locations where demolition and open burning of munitions occur. The area also contains disposal grounds for explosive-contaminated material and old equipment from TNT drying and flaking facilities. At least two burning areas, one now closed, are located there. Demolition pits are currently used for demilitarization (demil) operations involving up to 5,000 lb of explosives above the ground and up to 10,000 lb of explosives with earth cover. The smaller amounts of explosives are detonated in uncovered areas, the larger ones in earth-covered areas. The western side of the hogback, in Fenced-Up Horse Valley, contains what appears to be former demolition or burning grounds.

Within the Demolition/Burning Area the following numbered SWMUs are identified: Demolition Craters (SWMU 3), Burning Ground (SWMU 4), Demolition Area Residue Piles (SWMU 5), and Old Burning Ground and Demolition Landfill (SWMU 13).

4.4.1 Demolition Craters, SWMU 3

4.4.1.1 Site History

The demolition craters, SWMU 3, are located inside a fenced area (Fig. 4.15) in the southwestern part of the FWDA. The Burning Ground (SWMU 4) and Demolition Area Residue Piles (SWMU 5) are also located within the fence. The craters have been used for destruction of various types of explosives, propellants, and pyrotechnics[29,31] on both sides of an arroyo since the early 1940s. The site includes many demolition craters, or pits, whose numbers may change from time to time. In an aerial photograph taken in 1948, three pits in the northern demolition area, two trenches to the south of the pits, and one trench in the western portion are identified. Three more pits are shown in one 1962 aerial photograph.[32] In 1981, 11 demolition craters were reported.[31]

Both open and covered demolition occurs under an interim permit issued by the New Mexico Environmental Improvement Division on the basis of a closure and post-closure plan submitted to the state. Explosives are placed in a trench. Open detonation is used for explosives of less than 2,250 kg (5,000 lb), while about 10 feet of earth cover blanket detonating of 4,500-kg (10,000-lb) explosives. The detonation procedure follows strict safety protocols. Until very recently, one detonation occurred every workday. (In the past, detonations may have occurred even more frequently.) Currently, there are reportedly no detonations. The FWDA schedule calls for detonation activity to begin approximately January 1991. A RCRA part B permit for open burning and detonation has been applied for.

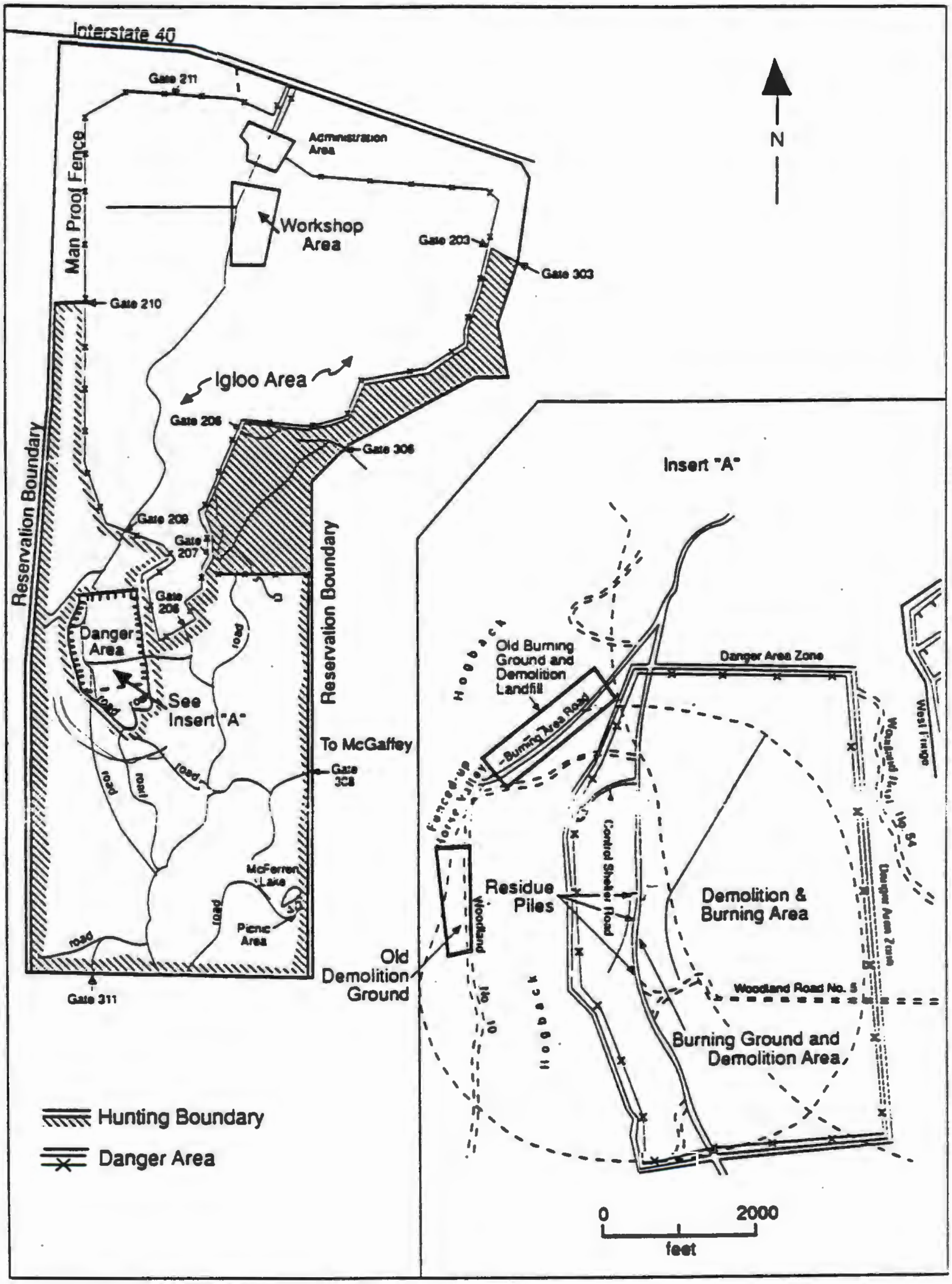


FIGURE 4.14 Locations of Demolition Craters, SWMU 3; Burning Ground, SWMU 4; Demolition Area Residue Piles, SWMU 5; and Old Burning Ground and Demolition Landfill, SWMU 13

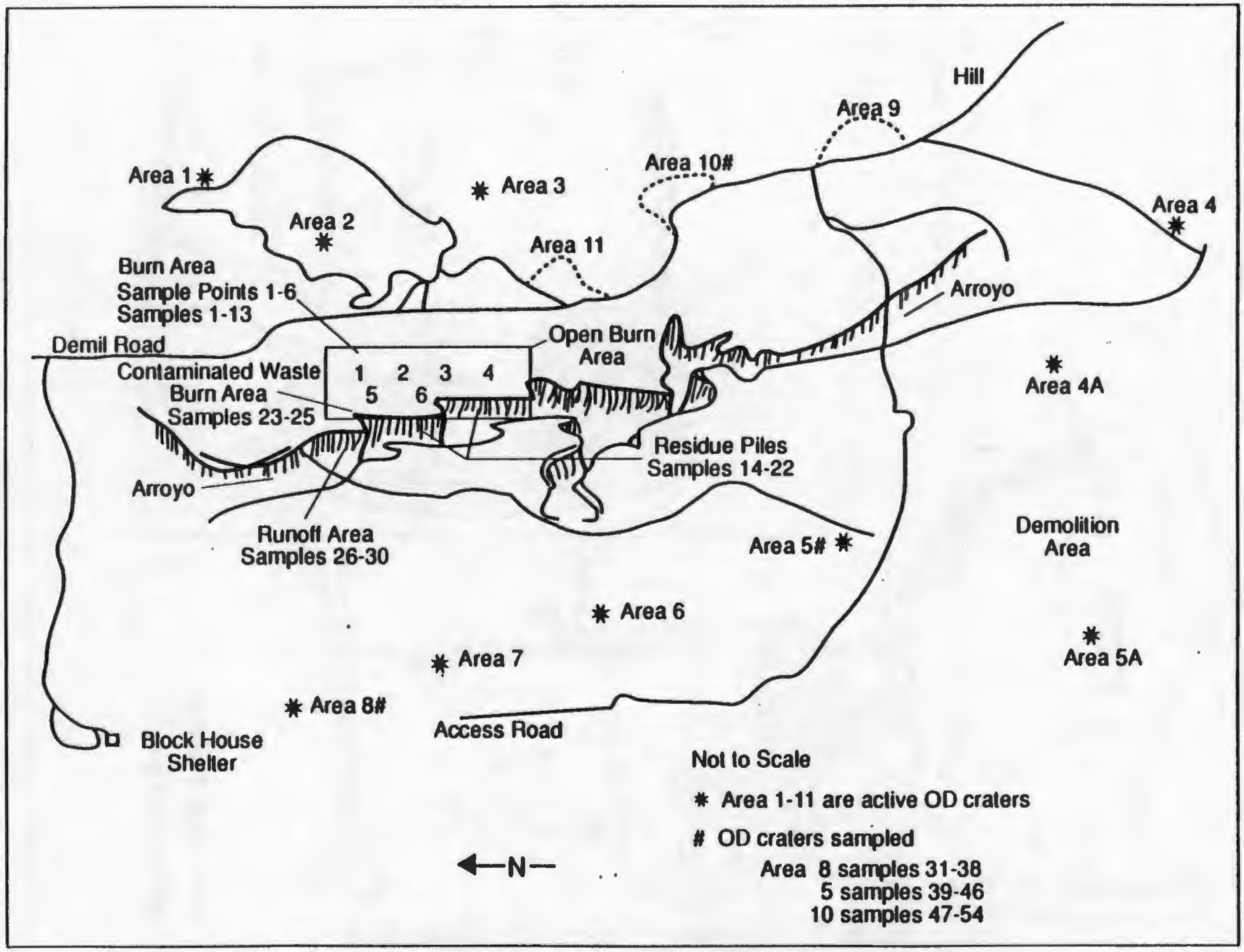


FIGURE 4.15 Approximate Locations of Demolition Craters, SWMU 3 (adapted from Ref. 21)

4.4.1.2 Geology and Hydrology

The crater site is situated on both sides of an arroyo running from south to north. A veneer of alluvium covers the Triassic Chinle Formation. The bedrock compositions of the banks of the arroyo differ from each other. Bedded calcareous sandstone dominates the eastern bank, massive mudstone the western bank. The different compositions lead to differences in the texture of the alluvium. Rock fragments are common in the alluvium of the eastern bank, and loamy clay in the alluvium of the western bank.

4.4.1.3 Nature and Extent of Contamination

Twenty-four soil samples were collected in 3 of the 11 demolition craters in 1981 and analyzed for EP toxicity metals and explosives. Of the three sampled craters (5, 8, and 10), two are located on the western side of the arroyo, one on the eastern side. Eight samples were taken from each crater. The results are listed in Table 4.4. Eight of 24 samples show cadmium concentrations ranging from 0.10 to 0.26 mg/L. One sample shows a selenium concentration at a level of 0.14 mg/L. These are below the RCRA EP toxicity regulatory levels. Minor amounts of explosives were also detected (Table 4.4). RDX (royal demolition explosive, hexohydro-1,3,5-trinitro-1,3,4-triazine) is found in 3 of 24 samples, ranging from 2.8 to 7.8 μg/g; in 2 of 24 samples, 2,4,6 TNT (trinitrotoluene) ranges from 1.1 to 1.9 μg/g; and one sample has HMX content of 1.4 μg/g.

One sediment sample and one surface water sample were collected from a pond about 800 ft downstream from the demolition area in 1981 (Table 4.5).[7] The samples demonstrate insignificant contamination. The pond receives discharge from the demolition area, either through a spring in the area or from rain or snow precipitations. In the sediment sample, an insignificant amount of bis(2-ethylhexyl) phthalate was found, at a level of 3 mg/kg. The surface water sample contains a minor amount of toluene, 10 μg/L. All other explosives and semivolatiles are below detected limits in both samples.

From the above results, it is concluded that the soil in the demolition craters area has been contaminated with metal and explosives. Transport of the contaminant through surface water is limited. The soil contamination is not homogeneous within each crater. The potential contaminated area may include all the craters that have been used. In addition to metal and explosive contamination, unexploded ordnance is a potential problem at this site because of previous detonations.

Because no groundwater sample was collected in this site, the extent of groundwater contamination, if present is not known.

4.4.1.4 Proposed Actions

It is recommended that an ordnance reconnaissance survey be conducted by the Army to locate surface and subsurface UXO and metal objects using appropriate techniques available to the Army.

TABLE 4.4 Chemical Results of Soil Sampling in the Demolition Craters

Sample No.	EP Toxicity[a] Concentration (mg/L)								Explosives[a] Concentration (mg/kg)					
	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	2,4 DNT	2,6 DNT	2,4,6 TNT	HMX	RDX	TETRYL
Crater 5														
039	BDL[b]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
040	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
042	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
043	BDL	BDL	BDL	0.11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
044	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
045	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
046	BDL	BDL	BDL	0.13	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Crater 8														
031	BDL	BDL	BDL	0.12	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
032	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
033	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
034	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
035	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
036	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
037	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
038	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.8	BDL
Crater 10														
047	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.9	BDL	BDL	BDL
048	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.14	BDL	BDL	BDL	BDL	BDL	BDL
049	BDL	BDL	BDL	0.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.4	7.8	BDL
050	BDL	BDL	BDL	0.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
051	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
052	BDL	BDL	BDL	0.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
053	BDL	BDL	BDL	0.16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
054	BDL	BDL	BDL	0.26	BDL	BDL	BDL	BDL	BDL	BDL	1.1	BDL	6.2	BDL
Detection Limit	0.5	0.5	10	0.1	0.5	0.2	0.5	0.1	1.0	1.0	1.0	1.0	1.0	1.0

[a]See Table A.1 for identification of constituents. [b]Below detection limit. Source: Ref. 31.

TABLE 4.5 Selected Chemical Results of Sediment and Surface Water Sampling in Demolition Area

Compound[a]	Sediment (mg/kg), FW18S	Surface Water (µg/L), FW18W
Semivolatile		
Bis (2-ethylhexyl) Phthalate	3	< 2
Chrysene	< 1	< 2
Fluoranthene	< 2.0	< 1
Naphthalene	< 0.4	< 2
Phenol	< 0.4	< 20
Toluene	NA	10
Explosive		
13 DNB	< 0.317	< 4.8
24 DNT	< 0.223	< 3.0
26 DNT	< 0.419	< 3.8
135 TNB	< 1.08	NA
246 TNT	< 0.194	NA
Nitrobenzene	< 1.64	< 17
RDX	< 2.61	< 10.5
Tetryl	< 1.5	< 23.9
White P	< 0.07	< 0.7
Total P	NA	40

[a]See Table A.1 for identification of compounds.

Source: Ref. 7.

In order to better understand the source and transport route of contaminants from the demolition craters, at least two sediment samples should be collected from each of the washes in the demolition area; three surface soil samples from each of the eight demolition craters not sampled before should also be collected. In the main arroyo, at least six sediment samples should be collected. Each sample should be taken from between the surface and a depth of 1 ft and should be analyzed for metals, total phosphate, and explosives.

Two monitor wells should also be installed in the alluvium in the main arroyo, one immediately downstream of the demolition area and one immediately upstream of the area. Groundwater taken from the wells should be analyzed for explosives, total phosphate, and metals. The results should provide information on whether groundwater contamination is present.

4.4.2 Burning Ground, SWMU 4

4.4.2.1 Site History

The main burn area is located on the eastern side of a valley immediately adjacent to an arroyo (Fig. 4.14), and is situated below the general area of the demolition craters (Sec. 4.4.1). The site has been used since 1955.[21] Before 1982, explosives and explosive-contaminated wastes were burned in the open, and all residues from the operations were bulldozed into the adjacent arroyo, forming a series of residue piles (SWMU 5) stretching several hundred feet. Residues include burned-out jet-assisted takeoff (JATO) bottles, empty 55-gal drums, and small metal parts.[27]

Since 1982, open burning has been conducted in two burning troughs and two burning trays. The troughs and trays are located several hundred feet north of the previous burning ground and were built to Army specifications.[27] Explosives and explosive-contaminated wastes are burned following strict safety protocols. Part of the residue is sent to the DRMO, and the rest is disposed of in residue piles (SWMU 5). The dimensions of the current burning ground are approximately 750 ft × 150 ft. The area is operated under an interim permit issued by the New Mexico Environmental Improvement Division on the basis of a closure and post-closure plan submitted to the State. A RCRA part B permit for open burning and detonation has been applied for.

It should be mentioned also that wastes from the operation of the Deactivation Furnace (Workshop Area) were sent to the burning pit area.

4.4.2.2 Geology and Hydrology

The site is situated on a flood plain deposited by a drainage running from south to north. The flood plain is eroded, forming an arroyo in the demolition area. The arroyo is dry except during rainstorms or snowmelts (dry most of the year).

Alluvial deposits of clay, silt, and sand are expected in the floodplain. Under arid environments, alluvium is estimated to be poorly sorted. Cracks are well developed in the upper part of the soil column, especially during dry seasons. Under the alluvium is the Triassic Chinle Formation of mudstones and calcareous sandstones.

The hydrogeologic condition of the demolition area is not fully known. An unconfined aquifer may be present in the alluvium. A spring has been reportedly tapped in the demolition area. Therefore, recharge of groundwater from springs is possible, besides from rain or snow precipitations. Also, surface water flows reportedly disappeared in the demolition area.[7] However, there are no available data regarding the depth of groundwater table, which is expected to fluctuate from time to time.

4.4.2.3 Nature and Extent of Contamination

Based on past operations, semivolatile, metal, and explosive contamination, and unexploded ordnance are the major concerns of this site. The last becomes a concern because the site is in the vicinity of the detonation craters. Fuel may also have been used in the burning activities, causing semivolatile contamination.

In 1981, 13 surface soil samples were taken from the pre-1982 burning area, and 3 samples from immediately north of the burning area. Many samples are found with explosive contamination. The results are (1) 13 of 16 samples have 2,4,6-TNT ranging from 1.9 to 2,810 μg/g, (2) 7 of 16 samples have RDX at a level ranging from 2.4 to 3,110 μg/g, (3) 7 of 16 have HMX at a level ranging from 2.0 to 765 μg/g, (4) one sample has 2,6-DNT at a level of 2.2 μg/g, and (5) two samples contain 2,4-DNT up to levels of 7.7 μg/g (see Table 4.6).

Minor metal contamination is found in the 16 samples (Table 4.6). From the EP toxicity test, lead and cadmium are found in 4 of the 16 samples. They range from 0.5 to 2.6 mg/L for lead and from 0.1 to 0.33 mg/L for cadmium.

Because the burning ground is in the vicinity of the open demolition craters, UXO constitutes a major concern at this site. Very little information is available in the record to document the amount and location of UXO that has been discovered in the area. Incidents of unplanned UXO explosions in the general area were reported to ANL staff by FWDA personnel.

4.4.2.4 Proposed Actions

The Army should conduct an ordnance reconnaissance survey in this area using available technology.

The sampling plan for this site may be integrated with the plan in the demolition craters (Sec. 4.4.1) and the residue piles (Sec. 4.4.3). Besides soil sampling in the arroyo, as suggested in Sec. 4.4.1, surficial soil should be grid-sampled in the up slope of all residual piles and in the valley, and analyzed for the total phosphorous, explosives,

TABLE 4.6 Chemical Results of Soil Sampling in the Burning Ground Area

Sample No.	EP Toxicity[a] Concentration (mg/L)								Explosives[a] Concentration (µg/g)					
	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	2,4 DNT	2,6 DNT	2,4,6 TNT	HMX	RDX	TETRYL
Burning Ground (SWMU 4a, Table 4.1)														
001	BDL[b]	BDL	13	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
002	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
003	BDL	BDL	113	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.1	BDL	BDL	BDL
004	BDL	BDL	45	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
005	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4.6	BDL	BDL	BDL
006	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10.0	BDL	BDL	BDL
007	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	8.9	BDL	BDL	BDL
008	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	51.0	BDL	BDL	BDL
009	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	88.0	2.0	2.4	BDL
010	BDL	BDL	735	0.33	BDL	BDL	2.1	BDL	BDL	BDL	1.9	12.0	32.5	BDL
011	BDL	BDL	38	0.30	BDL	BDL	2.6	BDL	BDL	BDL	5.9	9.3	30.2	BDL
012	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	7.7	2.2	810	680	3060	BDL
013	BDL	BDL	666	BDL	BDL	BDL	BDL	BDL	6.2	BDL	2020	765	3110	BDL
Immediately North of Burning Ground														
023	BDL	BDL	10	0.10	BDL	BDL	1.3	BDL	BDL	BDL	19.0	12.1	13.5	BDL
024	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	403.0	3.1	12.4	BDL
025	BDL	BDL	BDL	0.12	BDL	BDL	0.5	BDL	BDL	BDL	2.5	BDL	BDL	BDL
Detection Limit	0.5	0.5	10	0.1	0.5	0.2	0.5	0.1	1.0	1.0	1.0	1.0	1.0	1.0

[a]See Table A.1 for identification of constituents.

[b]Below detection limit.

Source: Ref. 31.

metals, and semivolatiles. Recommended spacing of the grid is 20 ft. The results of the sample should be useful for determining the nature and the extent of soil contamination caused by pre-1982 burning. If significant contamination is recognized in some areas, soil borings may be necessary to define the depth of the contamination.

In the active burning ground, soil samples should be collected around the burning troughs and the burning trays. The samples should be analyzed for total phosphorous, explosives, metals, and semivolatiles.

Two monitoring wells are also recommended for the demolition crater site (Sec. 4.4.1), and their results should be useful in evaluating groundwater contamination, if present, in the Burning Ground.

4.4.3 Demolition Area Residue Piles, SWMU 5

4.4.3.1 Site History

This site is situated in the demolition area immediately downslope from the pre-1982 burning area. Residues from the open burning of explosives and explosive-contaminated wastes were bulldozed downslope into an arroyo, forming a series of residue piles stretching for several hundred feet. At least three discernible areas were identified. Part of the scrap metal from the burning trays might have been disposed of in this site. Wastes include open burning residues, metal banding from ammunition packaging, 55-gal drums, small metal parts, and burned-out JATO bottles.[21]

4.4.3.2 Geology and Hydrology

The site is located on the slope of an arroyo downslope from the pre-1982 burning area. Alluvial deposits are exposed on both banks of the arroyo. In geology and hydrology, this site is similar to the Burning Ground (Sec. 4.4.2.2).

4.4.3.3 Nature and Extent of Contamination

Nine surficial soil were sampled in 1981 on the slope where the residue piles were located. Metal and explosive contamination were found (Table 4.7). All nine samples are contaminated with barium, HMX and RDX, barium from 11 to 759 mg/L, HMX from 13.4 to 107 mg/kg, and RDX from 16.6 to 492 mg/kg. Eight of the nine have 2,4,6-TNT at levels from 37.1 to 3180 mg/kg. Lead is found in five of nine samples ranging from 0.5 to 4.5 mg/L. Insignificant amounts of cadmium, 2,4-DNT, and tetryl are shown in a few samples.

The residue piles stretch discontinuously a few hundred feet in the demolition area. In some locations, they appear to be at least several feet thick.[21] The exact size and depth of the piles are not identified.

TABLE 4.7 Chemical Results of Soil Sampling in the Residue Pile Area

Sample No.	EP Toxicity[a] Concentration (mg/L)								Explosives[a] Concentration (mg/kg)					
	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	2,4 DNT	2,6 DNT	2,4,6 TNT	HMX	RDX	TETRYL
014	BDL[b]	BDL	12	BDL	BDL	BDL	BDL	BDL	6.7	BDL	3180	62.1	204	BDL
015	BDL	BDL	69	0.94	BDL	BDL	4.5	BDL	BDL	BDL	337	102	241	BDL
016	BDL	BDL	208	BDL	BDL	BDL	BDL	BDL	BDL	BDL	75.4	13.4	29.5	BDL
017	BDL	BDL	449	0.13	BDL	BDL	2.8	BDL	BDL	BDL	37.1	22.8	25.8	BDL
018	BDL	BDL	119	BDL	BDL	BDL	BDL	BDL	BDL	BDL	485	14.4	37.5	1.8
019	BDL	BDL	11	BDL	BDL	BDL	BDL	BDL	BDL	BDL	755	32	137	1.3
020	BDL	BDL	13	BDL	BDL	BDL	0.70	BDL	BDL	BDL	320	48.1	16.6	BDL
021	BDL	BDL	122	BDL	BDL	BDL	1.8	BDL	NA[c]	BDL	BDL	107	492	21.7
022	BDL	BDL	759	BDL	BDL	BDL	0.50	BDL	2.0	BDL	447	15.1	46.6	BDL
Detection Limit	0.5	0.5	10	0.1	0.5	0.2	0.5	0.1	1.0	1.0	1.0	1.0	1.0	1.0

[a]See Table A.1 for identification of constituents.

[b]Below detection limit.

[c]Not available.

Source: Ref. 31.

Because the residue piles are in the vicinity of the open demolition craters, UXO constitutes a major concern at this site. Very little information is available in the record to document the amount and location of UXO that has been discovered in the area. Incidents of unplanned UXO explosions in the general area were reported to ANL staff by FWDA personnel.

4.4.3.4 Proposed Actions

We recommend that the Army conduct an ordnance reconnaissance survey in this area using available technology.

A field visual survey should also be conducted to delineate the boundaries of the residue piles. Once the boundaries are delineated, removal of the residue piles is recommended since they have been found to be hazardous. The wastes should be disposed of as hazardous waste.

Surficial soil samples should be collected along the stretch of the piles and at the toe of the piles. A spacing of 20 ft may be used. Precaution should be taken to avoid unexploded ordnance. The sampling plan may be integrated with the plans for the Demolition Craters and Burning Ground (Secs. 4.4.1.4 and 4.4.2.4). The results should help to delineate the extent of contamination caused by the residue piles.

4.4.4 Old Burning Ground and Demolition Landfill, SWMU 13

4.4.4.1 Site History

The site is located in the Fenced-Up Horse Valley (an arroyo) at the end of Burning Area Road and on both sides of the road (Figs. 4.14 and 4.16). According to Fort Wingate personnel, the site was used from about 1948 to probably 1955 to receive explosive-contaminated wastes from the Ammunition Washout Plant during and after the plant operation. Old equipment from the TNT drying and flaking operation was removed from Bldg. 503 during the renovation of the building. The equipment was reportedly dumped in the arroyo without being decontaminated or washed. Wastes were not decontaminated prior to land disposal.[1]

According to documents dated from late 1954 to early 1955,[33] the site might have included burning activities even after 1955. The burning ground covered an area about 1,400 long and 200 ft wide along the embankment of an arroyo. The site was permitted by the Department of the Army, Washington, D.C.,[34] as a burning site with an explosive limit of 30,000 lb. In maps from the later 1950s, only the western end of the site was marked as a burning ground. At the time ANL personnel visited the site in June 1990, bomb shells were found in the bottom of the arroyo in the western part of the site, while drums were found near the eastern part of the site.

The major concerns at this site are metal and explosive contaminations. Assuming that the operational practices at the site were the same as those now used at

Appendix D
Toxicity Reference Information

- *Sample Action Level Calculations and Exposure Assumptions*

- *Table 6. Acute Toxicities of Munitions Compounds to Rodents*
- *Table7. NOEL for Selected Munitions Compounds Estimated from Chronic and Subchronic Toxicity Data*

Source for Tables 6 and 7:
Burrows, Elizabeth P., et al,
"Organic Explosives and Related Compounds: Environmental and Health Considerations", 1989

Environmental Resources Management, Inc.

ERM

WO Number PM 306.12.01 Sheet 1 of 1
Project Fort Wingate - USATHEMA
Subject Sample of Action Level Calc.
By A. Baines Date 2/9/93
Chkd by C. Blundell Date 2/9/93

RDX - Class C carcinogen

$$C_m = \frac{R \times BW \times LT}{CPF \times IR \times CF \times ABS \times ED}$$

where:

C_m = action level in soil (mg/Kg)
R = Risk ($1E^{-5}$) ✓
BW = 70 Kg for an adult ✓
LT = lifetime (yrs)
CPF = Carcinogenic potency factor $(mg/Kg/d)^{-1}$ $1.1E^{-1} \left(\frac{mg}{Kg\,d}\right)^{-1}$ ✓
IR = Ingestion Rate (mg/d)
ABS = Absorption factor - assumed to be 1 by Subpart S
ED = Exposure duration (yr)
CF = Conversion factor $\frac{Kg}{mg}$

$$= \frac{(1 \times 10^{-5}) \times (70\,Kg) \times (70\,yrs)}{\left(1.1E^{-1}\,\frac{Kg\text{-}d}{mg}\right) \times \left(100\,\frac{mg}{d}\right) \times \left(\frac{1E^{-6}\,Kg}{mg}\right) \times (1) \times (70\,yr)}$$ ✓

$$= \frac{0.049}{0.0008\,\frac{Kg}{mg}}$$ ✓ ✓

$$= 63.6\,\frac{mg}{Kg}$$ ✓

$$= 64\,\frac{mg}{Kg}$$ Subpart S action level ✓

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WO Number PM306.12.01 Sheet 1 of ____
Project Ft. Wingate - USATHEMA
Subject Sample of Action level Calcs
By A. Baines Date 2/9/93
Chkd by C. Blundell Date 2/9/93

1, 3, 5-Trinitrobenzene - noncarcinogenic

$$C_m = \frac{BW \times RfD}{IR \times CF \times ABS}$$

where

C_m = action level in soil $\left(\frac{mg}{Kg}\right)$
BW = Bodyweight of a child (16 Kg)
RfD = reference dose $\left(5E^{-5} \frac{mg}{Kg\text{-}d}\right)$ ✓
CF = Conversion factor $\left(1E^{-6} \frac{Kg}{mg}\right)$ ✓
IR = ingestion rate - child (200 mg/d) ✓
ABS = absorption factor - assumed to be 1

$$\frac{16\ \cancel{Kg} \times 5E^{-5} \frac{mg}{\cancel{Kg \cdot d}}}{200 \frac{\cancel{mg}}{\cancel{d}} \times 1E^{-6} \frac{Kg}{\cancel{mg}} \times 1}$$ ✓

$$\frac{0.0008\ mg}{0.0002\ Kg}$$ ✓

$= 4 \frac{mg}{Kg}$ Subpart S action level ✓

Exposure Assumptions
for Action Level Calculation
Ft. Wingate, NM

			Carcinogenic Exposure Assumptions Class B	Carcinogenic Exposure Assumptions Class C
Cm	=	$\frac{R \times BW \times LT}{CPF \times IR \times CF \times ABS \times ED}$		
Where				
Cm	=	Action Level in Soil (mg/kg)		
R	=	Acceptable Risk, based on Carcinogenic Classification	1.00E-06	1.00E-05
BW	=	Body Weight, Adult (kg)	70	70
CF	=	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
LT	=	Life time (yrs)	70	70
CPF	=	Constituent Specific CPF (mg/kg/d)^-1		
IR	=	Ingestion Rate (mg/d)	100	100
ABS	=	Absorption Factor: assumed to be 1 for Subpart S	1	1
ED	=	Exposure Duration (yr)	70	70
		Carcinogenic Intake Factor	0.7	7

(2) USEPA RCRA Subpart S 55 FR 30798, July 27, 1990

Exposure Assumptions
for Action Level Calculation
Ft. Wingate, NM

			Noncarcinogenic Exposure Assumptions
Cm	=	$\frac{BW \times RfD}{IR \times CF \times ABS}$	
Where			
Cm	=	Action Level in Soil (mg/kg)	
BW	=	Body Weight, Child (kg)	16
RfD	=	Constituent Specific RfD (mg/kg/d)	
IR	=	Ingestion Rate (mg/d)	200
CF	=	Conversion Factor (kg/mg)	1.00E-06
ABS	=	Absorption Factor: assumed to be 1 for Subpart S	1
		Noncarcinogenic Intake Factor	80000

(2) USEPA RCRA Subpart S 55 FR 30798, July 27, 1990

Table 6. Acute Toxicities of Munitions Compounds to Rodents

Compound	Rat mg/kg[a] (route)	Mouse mg/kg[a] (route)	Reference
TNT	800-1300 (oral)	600-1000 (oral)	214
DNT	200-800 (oral)	1200-2000 (oral)	215
NG	500-900 (oral)	500-1200 (oral)	216
	100-110 (ip)	100-200 (ip)	216
	25-32 (iv)	10-18 (iv)	216
	500-600 (sc)	30-500 (sc)	216
RDX	40-300 (oral)	60-500 (oral)	201
		19 (iv)	201
HMX	5250 (oral)	2300 (oral)	217
		634 (sc)[b]	207
NQ	>5000 (oral)	5000 (oral)	195,208,209
TNB	450 (oral)	572 (oral)	63
		32 (iv)	63
DNB	83 (oral)	200 (ip)[c]	63
DEGDN	700-1000 (oral)[d]	1300-1400 (oral)[d]	218
	777 (oral)		63
EGDN	616 (oral)		63
PGDN	250 (oral)		63
	479 (ip)	1047 (ip)	63
	463 (sc)	1208 (sc)	63
PA		100 (oral)[e]	63
Tetryl		5000 (sc)[f]	63

a. LD50 unless noted otherwise.
b. In rabbit.
c. LDLo.
d. LD100.
e. LDLo in guinea pig.
f. LDLo in dog.

Table 7. NOEL for Selected Munitions Compounds Estimated from Chronic and Subchronic Toxicity Data

Compound	Duration of Test	NOEL (mg/kg/day)	Species	Reference
TNT	13 wk	1.0[a]	rat	219
	13 wk	1.4-1.45[b]	rat	220
	13 wk	1.45-1.6[b,c]	mouse	220
	13 wk	0.2	dog	220
	26 wk	0.5[d]	dog	221
	2 yr	0.4	rat	222
DNT	1 yr	13.5	mouse	223,224
	1-2 yr	0.6	rat	223,225
	2 yr	0.2	dog	223
NG	13 wk	25.5	rat	226
	1 yr	1.0	dog	227
	2 yr	3-4[b]	rat	227
	2 yr	10-11[b]	mouse	227
RDX	13 wk	15	rat	202
	13 wk	80	mouse	202
	13 wk	1.0	monkey	202
	2 yr	0.3	rat	228
	2 yr	1.5	mouse	229
HMX	13 wk	50-115	rat	207
PA	2 yr	25[e]	rat	230
NQ	13 wk	316	rat	210
DNB	16 wk	0.75	rat	231,232
PETN	1 yr	2	rat	196

a. 5% reduction in weight gain.
b. Males and females were given slightly different doses.
c. Enlarged spleens and hearts.
d. Mild liver lesions observed in 7 of 12.
e. Calculated from concentration in feed (500 ppm), assuming standard animal weight (200 g) and feed consumption (10 g/day)[63].

Source: Burrows, Elizabeth P., David H. Rosenblatt, Wayne R. Mitchell, David L. David L. Parmer, 1989. "Organic Explosives and Related Compounds: Environmental and Health Considerations." US Army Biomedical Research & Development Laboratory, Fort Detrick, Fredrick MD. Technical Report 8901.

Appendix E
Excerpts from the Sampling and Analysis Plan of the "Environmental Investigation (EI) Work Plans for Areas Requiring Environmental Evaluation at Fort Wingate Depot Activity (FWDA), November 1992

- *4.0 - Field Methods*
- *5.0 Sample Management*
- *6.0 - Field Documentation*
- *7.0 - Equipment Decontamination*

4.0 FIELD METHODS

This section details the methods that will be used to drill and sample soil borings; construct, design, and sample monitor wells; sample surface water and sediments; collect wipe and chip samples; and, conduct topographical surveying.

4.1 SOIL

This section describes soil boring and subsurface soil sampling procedures as well as surface soil sampling procedures.

4.1.1 Soil Borings

Soil borings will be drilled to obtain subsurface soil samples and to install monitor wells. If a monitor well is not going to be installed for a given boring, drilling will be done using either a 3.25 or a 4.25-inch inside diameter (ID) hollow-stem auger (HSA). If a monitor well is going to be installed, drilling will be done with a 6.25-inch ID HSA.

Subsurface soil samples will be collected at both monitor well and soil-boring locations using either a split-spoon sampler or a split-barrel continuous sampler for samples that will be analyzed for chemicals. Either type of sampler will be advanced in the borehole utilizing a HSA rig. The split-spoon sampler will be a 3.0-inch OD tube with a length of 24 inches. The hammer drop will be 30 inches when driving split-spoons. The Standard Penetration Test (SPT) blow counts will be recorded for each 6-inch interval, and the "N" count will be the sum of the blows for the second and third intervals. The split-barrel continuous sampler will be either a 3.25 or a 4.25-inch outside diameter tube, with a length of 5 feet. The continuous sampler will be used when sampling SWMUs that require analyses in addition to a standard TCL and TAL scan, or whenever the sample volume needed exceeds the capacity of the split-spoon. A 24-inch long, 3.0-inch ID, thin-walled Shelby Tube sampler will be used to collect samples from soil boring and monitor well locations at zones where a major change in lithology occurs. The Shelby Tube will be pushed into the interval to be sampled by the drill rig. The tube will be allowed to sit in place in the borehole for at least ten minutes to allow the sample to expand. Then the Shelby Tube will be slowly rotated in place and allowed to stand for another ten minutes before it is removed from the hole. When the full tube is removed from the hole and recovered, the geologist will log the material type in the top and bottom of the tube. Then the tube will be sealed with hot wax at both ends, capped, taped, and sealed with another layer of hot wax. The tube will be labelled, indicating the boring number, sample interval, Shelby tube number, date, time, which end is up, and the project number. All samples will be submitted to a geotechnical laboratory for the following analyses: grain size; moisture content; direct shear strength; permeability; Atterburg Limits; Standard Proctor Tests; and, consolidation testing.

Soils will be classified using the Unified Soil Classification System (USCS), and either the Munsell Soil or Geological Society of America (GSA) Rock Color Charts. The information listed in Section III.b.5 of USATHAMA (1987) will be recorded on the boring log shown in Figure 4-1.

Soil samples will be collected into appropriate containers for the type of analysis to be done. Table 5-1 lists the types of sample containers, preservatives, and holding times for soil samples. The following procedure will be used in obtaining soil samples.

1. Inspect the split spoon or split-barrel continuous sampler to ensure that proper decontamination of the sampling equipment has been performed according to the procedures described in Section 7.2. For a split spoon, the sampler will be driven into the undisturbed soil below the lead auger. After the sampler has been driven 24 inches, withdraw from the borehole and open. When the continuous sampler is used it will be placed inside the lead auger and advanced with the auger for a full five foot run. After the sampler has been advanced 5 feet it will be withdrawn from the borehole and opened.

2. Immediately after opening the sampler, scan the sample with an OVA or HNu and "peel." Peeling is accomplished by removing the part of the sample that was in contact with the sides of the sampler, including the ends of the sample.

3. If the samples are to be analyzed for volatile organics, fill the sample container immediately after peeling the sample, allowing the least amount of time possible for volatilization of the sample after it has been withdrawn from the boring.

4. Visually examine the sample for lithology and physical characteristics. Log the sample, being sure to include all the required information listed in USATHAMA (1987) on the boring log.

5. Place the remaining sample material into a stainless steel mixing bowl and mix.

6. Collect the required volumes of sample for other chemical analyses in the following order: (1) semi-volatiles, (2) pesticides, (3) polychlorinated biphenyls (PCBs), (4) explosives, and (5) inorganics. Label the containers and seal.

7. Collect a one pint sample for record and physical analysis (5% of the samples collected for physical analysis will be submitted to a geotechnical laboratory for USCS classification).

8. Complete the chain-of-custody form, shown on Figure 5-1. Place the sample containers into a cooler with ice to preserve the sample at 4°C.

9. Grout borehole to the ground surface using a grout mix consisting of 20 parts of neat Portland cement (Type II or V), mixed with one part of commercial bentonite powder (previously approved by USATHAMA) and 8 gallons of water for each 94-pound bag of cement. The bentonite will be added to the mixture after the cement and water have been mixed. The grout will be placed using a tremie pipe set just above the bottom of the boring.

10. Enter the boring log information as described in Section 6.

11. Complete the borehole data form shown in the Technical Plan (TP).

12. Complete one borehole interval data form as shown in the TP for each interval in the boring.

4.1.2 Surface Soil Sampling

For purposes of this plan, surface soils are considered to include any soil within 24 inches of the ground surface. Samples of surface soils will be collected using either a hand auger or a spade/trowel, following the steps outline below.

1. Using a decontaminated auger, trowel, or spade, remove soil to the required total depth and place into a stainless steel mixing bowl.

2. Immediately fill and seal the sample container for volatile organics analysis, if required.

3. Scan the remaining sample with an OVA or HNu and record results in the log book.

4. Remove any grass or roots from the remaining sample, and log the sample, including all pertinent information listed in Section 4.1.1.

5. Mix the remaining sample material and collect the required volumes of sample for other chemical analyses in the following order: (1) semi-volatiles, (2) pesticides, (3) PCBs, (4) explosives, and (5) inorganics. Label and seal the containers.

6. Complete the chain-of-custody form. Place the sample containers into a cooler with ice to preserve the sample at 4°C.

7. Document the sample information as described in Section 6.

4.2 GROUND WATER

This section details how monitor wells shall be constructed. It documents installation procedures in addition to outlining well development procedures and sampling procedures.

4.2.1 Monitor Well Design and Installation

Ground water monitor wells will be installed in unconsolidated materials using a nominal 6.25-inch I.D. or larger HSA to a depth of ten to fifteen feet into the water table. If significant water is not found in unconsolidated materials then no well will be set. Because of the significant depth to the regional bedrock aquifer (1100 to 1500 feet) no bedrock wells will be installed. Soil sampling during HSA drilling will be done as described in Section 4.1. Installation of monitoring wells is described below.

1. The monitor well boring will be logged by a qualified geologist using the split spoon/continuous sampler samples of the soil material. Water levels will be noted on the geologist's log and the monitor well will be installed in the saturated zone as specified for each location.

2. Wells will be constructed using 4-inch ID polyvinyl chloride (PVC). Screens will be ten feet long and have 0.010-inch continuous slot openings. The casing, screen, and bottom plug will be flush-threaded. Prior to threading, all threads will be wrapped with Teflon tape to ensure ease of threading and obtaining a proper seal.

3. The annular space around the well screen, extending five feet above the top of the screen, will be filled with clean 20/40 washed Colorado Silica Sand, or equivalent, that has been approved by USATHAMA. The augers will be pulled from around the screen area to allow

the sand to fill the void space left by the augers. The sand level will be checked and maintained at a minimum of one foot inside the augers as they are being pulled from around the screen.

4. A minimum 5-foot thick bentonite seal (1/4-inch pellets, previously approved by USATHAMA) will be slowly poured into the annular space on top of the filter pack. The depth to the top of the seal will be measured to confirm proper placement. If water is not present in this portion of the borehole, the bentonite will be hydrated after placement by pouring clean, potable water from an approved source onto the seal. A bentonite slurry seal will be used only if the seal location is too far below water to allow for pellet placement, in which case a highly viscous bentonite slurry seal will be placed using a tremie pipe. The maximum thickness for a slurry seal will be five feet.

5. A grout seal will be installed from the top of the bentonite seal to the land surface and allowed to settle. The grout mix will consist of 20 parts of neat Portland cement (Type II or V), mixed with one part of commercial bentonite powder (previously approved by USATHAMA) and 8 gallons of water for each 94-pound bag of cement. The bentonite will be added to the mixture after the cement and water have been mixed.

6. A cap will be placed over the top of the PVC well casing to prevent the entry of any foreign matter into the well. This cap will not be vented; so it will be left loose enough to prevent the creation of a vacuum inside the well.

7. An 8-inch steel protective casing will be installed over the top of the PVC well casing by pushing the protective casing into the grout. A concrete well apron will be poured around the protective casing in such a manner that it directs any surface water away from the well head. Weep holes will be drilled into the protective casing just above the concrete pad. Upon completion of the well a Well Completion Record, shown in the TP, will be completed.

8. Four protective posts will be placed in concrete around the wellhead in a square shape manner so as to prevent damage to the wellhead from accidental contact by heavy equipment.

9. The monitor well will not be disturbed for a minimum of 48 hours and a maximum of seven calendar days before well development will begin, to allow the well construction materials (bentonite and grout) to properly set. Well development will be performed by mechanical pumping, supplemented if necessary by using a surge block and bailing to remove the

INTERIM DRAFT

5.0 SAMPLE MANAGEMENT

Samples collected in the field during this EI will be managed to ensure proper identification and control. Details of the overall EI program sample management requirements are given in the FSP and the QAPP. In this section, those sample management procedures that will be followed in the field are outlined.

5.1 QUALITY CONTROL SAMPLE TYPES

During sampling, a number of QC samples will be collected and submitted for laboratory analysis. The number and frequency of QC sample collection is determined by the individual project requirements and is outlined in this section.

A list of the types of QC samples that will be collected along with a brief description of each sample type is outlined in the following sections.

5.1.1 Trip Blanks

Trip blanks will be collected for chemical analysis of volatile organics and total petroleum hydrocarbons. The analytical results serve as a baseline measurement of volatile organic contamination that samples may be exposed to during transport and laboratory storage prior to analysis.

Trip blanks originate in the analytical laboratory. They are comprised of ASTM Type II reagent water for organic analyses. The water is placed in the appropriate sample containers by the subcontracting laboratory, transported to the sample collection site, stored along with the samples, and returned to the laboratory along with samples of water and/or soil collected for volatile organic analysis and total petroleum hydrocarbons. The trip blank containers will not be opened in the field.

One trip blank is included in each shipping cooler containing samples for volatile organics or total petroleum hydrocarbon analyses. The sample containers will later be stored in the laboratory with the samples and analyzed for the appropriate parameters.

5.1.2 Equipment Blanks/Field Blanks

Equipment blanks will be collected for each piece of sampling equipment used in the collection of samples when devices other than the sample bottle itself are required. The analysis of these blanks serves to verify the cleanliness of the sampling equipment. These samples will be placed in sample containers by the laboratory and transported to the sample collection site. The container will then be opened and a sufficient amount poured into the sampling device following equipment decontamination procedures, transferred back to the sample bottle, and returned to the laboratory for analysis. The equipment blanks will be analyzed for the same parameters as the associated samples. One equipment blank will be collected for each 20 samples, or approximately one blank per week.

If samples are collected directly into the sample containers, field blanks will be submitted instead of equipment blanks. The field blanks will consist of USATHAMA approved water that will be poured into the appropriate sample containers in the field, shipped to the laboratory with the field samples, and analyzed at the laboratory for the same parameters as the associated field samples. Field blanks, if collected, will be collected at a rate of one per 20 samples, or approximately one per week.

5.1.3 Field Duplicates

Field duplicates are defined as additional samples collected at a single sampling location during a single episode of sampling. Analysis of these duplicates provides statistical information relating to sample variability and serves as a check on the precision of sample collection methods as well as analytical procedures.

Ten percent of all samples will be collected in duplicate and submitted for laboratory analysis. Field duplicates will be labeled so that persons performing laboratory analyses cannot distinguish duplicates from other samples.

5.2 SAMPLE PRESERVATION AND CONTAINERS

Table 5-1 lists the type of containers and preservatives required by the laboratory and the maximum holding time allotted for each analysis. The field crew or site manager will make arrangements to procure sample preservatives and decontaminated sample containers, including those necessary for field quality assurance samples, from the laboratory.

Table 5-1

Sample Containers and Preservation

Parameter	Containers[1] Water	Containers[1] Soil	Preservatives Water	Preservatives Soil	Maximum Holding Time
TCL Organics					
VOCs	40 mL, G	500 g, G	HCL to pH <2 4°C	4°C	14 days
SVOCs	1 L, G	500 g, G	4°C	4°C	7 days until extraction 40 days after extraction
Pesticides/PCBs	1 L, G	250 g, G	4°C pH 5-9 $Na_2S_2O_3$	4°C	7 days until extraction 40 days after extraction
Herbicides	1 L, G	250 g, G	4°C	4°C	7 days until extraction 40 days after extraction
TAL Inorganics					
Mercury	1 L, P	250 g, G	HNO_3 to pH <2	4°C	28 days
Others	1 L, P	250 g, G	HNO_3 to pH <2	4°C	6 months
TPH	32 oz., G	1 L, G	HCL to pH <2 4°C	4°C	7 days
Ions					
Total Phosphorous	500 mL, P	250 g, G	H_2SO_4 to pH<2	4°C 4°C	28 days
Nitrate/Nitrite	500 mL, P	250 g, G	H_2SO_4 to pH <2 4°C	4°C	28 days
Sulfate	500 mL, P	250 g, G	4°C	4°C	28 days
Explosives	1 L, G	500 g, G	4°C store in dark	4°C store in dark	7 days until extraction 40 days after extraction

[1] G, glass; P, high density polyethylene with unlined polyethylene cap.

5.3 CHAIN OF CUSTODY

The Field Manager is responsible for overseeing and supervising the implementation of proper sample custody procedures in the field. The Field Manager is also designated as the field sample custodian and is responsible for ensuring sample custody until the samples have been transferred to a courier and sent directly to the laboratory.

A chain-of-custody form (Figure 5-1) will be completed in the field and will accompany the samples to the laboratory. This chain-of-custody form will be used to document transfer of samples as detailed in the QAPP and to communicate information that the laboratory will need for entry into IRDMIS, as described in the DMP.

5.4 SAMPLE IDENTIFICATION

Field samples, taken for laboratory analysis, require a unique identification code for site identification (10 characters) and field sampling number (8 characters). The following code system will be used for site identification:

XXXYYYYZZZ

where:

XXX	=	SWMU number from the Enhanced Preliminary Assessment Report report. If the area is not a designated SWMU, but is an AOC (Area of Concern), it will receive a 900 series number, e.g., AOC A = 901, AOC B = 902, etc.
YYYY	=	Field reserved for future use.
ZZZ	=	Location of sampling point at the SWMU. Each sampling location at each SWMU will be assigned a unique number. The location and sampling number will be plotted on a map.

For example, 0240000003 would be location 3 at SWMU 24.

The following code system will be used for field sampling numbers:

WXXXXYYY

where:

W	=	Sample type. 1 - field sample 2 - trip blank 3 - equipment blank 4 - field duplicate
XXXX	=	Unused.
YYY	=	Sequential sample number to be assigned in the field.

For example, 10000001 would be the first field sample taken at a particular sampling location.

5.5 SAMPLE PACKAGING AND SHIPPING

Following sample collection, all samples shall be brought to an on-site location for batching and paperwork checks. At this central location, like sample types are matched (i.e., solids, liquids, etc.) with similar sample types from all sample locations. Labels and log information are checked to ensure there is no error in sample identification. The samples are packaged to prevent breakage and/or leakage, and the shipping containers are labeled in accordance with the DOT regulations for transport.

As soon as field personnel are ready to transport samples from the field to the laboratory, the laboratory shall be notified by telephone of the shipment along with the estimated time of arrival. All samples shall be shipped directly to the laboratory via an overnight carrier. The field team shall determine whether it is best to directly transport the packages to the shipping office or to arrange for on-site pick-up. For each sample shipment to a specific subcontracting laboratory, an overnight air bill must be properly completed.

In order to ensure safe, secure delivery of all collected samples to the subcontracting laboratory, the following packaging and shipping procedures have been prepared for this project. All procedures presented below are written to comply with applicable DOT regulations for transportation by surface and/or air.

The collected data shall be recorded in the field logbook along with the documentation of the shipping procedures utilized. Any pertinent information in regards to particular sample hazards (i.e., any dangers anticipated upon opening of the sample bottle) is included on the chain-of-custody form.

Unless field collected information indicates otherwise, all environmental samples collected shall be treated as non-hazardous aqueous liquids and non-hazardous soils.

Because of the expected non-hazardous nature of the collected samples, packaging and shipping criteria have been designed only to maintain chain of custody as well as to prevent breakage of the sample containers. The packaging and shipping procedures shall be as follows:

- Place a layer of cushioning material (e.g., vermiculite) in the bottom of the watertight insulated metal or equivalent strength plastic shipping containers;
- Wrap the properly labeled and secured glass sample bottles and purgeable vials with plastic bubble wrap. Place the wrapped containers into watertight zip lock bags and seal the bags closed;

- Place sample bottles (top side up) into the shipping container arranging the bottles so that the glass bottles are surrounded by plastic bottles;
- Using the necessary packing material, pack the sample bottles to ensure that they do not shift during transport;
- Fill any void spaces of the shipping container, around and on top of the sample bottles, with ice cubes or chips sealed in plastic bags or with blue ice;
- Seal the appropriate chain-of-custody form(s) in a zip-lock plastic bag, and tape it securely to the inside of the shipping container lid;
- Close and lock/latch the shipping container. Seal the joint between the container body and lid with waterproof tape. (If the shipping container used is a picnic cooler, tape the drain plug closed to prevent any leakage of water as the ice packs melt during transport.);
- Apply several wraps of chain-of-custody tape around the shipping containers perpendicular to the seal to ensure that the lid remains closed if the latch is accidentally released or damaged during shipment. Do not obscure any stickers or labels on the shipping container with the chain of custody tape;
- Place a completed overnight carrier air bill on the lid of the shipping container. Include the name, address, and telephone number of the receiving laboratory and the return address and telephone number of the shipper on the air bill;
- Place a "This End Up" label on the lid and on all four sides of the shipping container; and
- Each shipping container must not weigh more than 150 pounds if it is to be shipped via an overnight carrier.

6.0 FIELD DOCUMENTATION

All sampling procedures, instrument calibration, and information pertinent to sampling conditions, progress, and field data collection will be documented following a prescribed set of guidelines. This documentation serves as a permanent and traceable record of all activities related to a specific field investigation project. The record will be legible and accessible to allow ease in verifying sampling activities and addressing future questions that may arise concerning such issues as sample integrity, sample traceability, etc.

To that end, several types of records that will be kept and maintained by project personnel in the field are discussed in this section. These are the field log book, equipment log book, health and safety log book, and various data forms. Other types of information that will be collected or maintained in the field are photographs, material certification records, and variance forms. Also discussed in this section is use of USATHAMA's IRDMIS software for data management

The Field Manager has overall responsibility for assuring the integrity of field records. This responsibility includes uniquely identifying each log book by type and a sequential number, tracking which field personnel are responsible for each book, maintaining original data forms in a three-ring binder, making copies of log books and forms for backup purposes and for transmittal to USATHAMA and to the Project Manager, and ultimately submitting originals to USATHAMA.

All field data entry will be done legibly using indelible ink on approved log books and forms only. All log books will be bound books with consecutively numbered pages. No pages will be skipped when filling in the log books. The integrity of field documentation is further ensured by the use of field log books containing paper treated to repel water. Should more than one log book of any type be required, they will be assigned by the Field Manager, numbered sequentially, and returned to the Field Manager when they are full or when field work is complete.

6.1 FIELD LOG BOOK

A field log book will be used by each field team group for documenting all pertinent project activities. Standard information recorded in the field log book includes general observations made in the field, identification and calibration of instruments used, and field data. Specific information requirements for field log books are discussed below.

The front of each field log book will contain the following information:

- Project name and number;
- Name of the contract under which the investigation is being conducted; and
- Name, address, and phone number of contractor;
- Date(s) of use;
- Unique log book identification number, as required.

The date and location (SWMU, well number, etc.) will be entered at the top of each page for easy reference. At the bottom of each page will be the signature of the person who made the log book entries on that page. The time of each entry will be noted using military (24-hour) time designations. Log entries will include the following information:

- Weather conditions (temperature, precipitation, windiness, cloud cover, etc.);
- List of the personnel present on-site during each sampling day to include all Contractor personnel, subcontractors, and visitors;
- Planned activities for the day;
- List of the equipment decontaminated along with a reference to the procedures used;
- Description of the sampling locations in reference to permanent landmarks;
- List of any changes from standard operating procedures, decisions made in the field, and other pertinent information (Note: This information must also be recorded on a Change Request/Documentation Form.);
- A description of QA/QC samples associated with the samples collected;
- Identification numbers of equipment used (if available);
- Sample preservation techniques used;
- Air monitoring information gathered (e.g., PID measurements) concerning air quality;
- Level of personal protection mandated (Level B, C, D) and record of time each field team member spent at each level (e.g., time spent in Level C developing a well, etc.);
- Other logs/paperwork used to document activities;
- Information on calibration of instruments, including instruments calibrated during the day, individuals who performed the calibration, and actual calibration information (Note: Instrument calibration information will be documented in the field log book as well as the calibration log book kept with each instrument.);

- List of the samples collected by media (i.e., soil, water, etc.);
- Comments relative to any problem areas that occurred during the day's activities, their final resolution, and any anticipated impact on the outcome of the field investigation; and,
- A summary of the days activities and planned activities for the next day.

6.2 FIELD EQUIPMENT LOG BOOK

A unique field equipment log book will be kept for each piece of field equipment (i.e., the HNu photoionization detector, pH meter, conductivity meter, etc.). This log book is used for the documentation of the proper use, maintenance, and calibration of the field equipment as well as for information concerning the conformance and decontamination status of each piece of equipment.

The field equipment log book is maintained and kept up-to-date following every use, maintenance, inspection, repair, and/or calibration of the equipment. The following entries will be made in the field equipment log book:

- Signature of the person making the entry;
- Date of entry;
- Status of equipment in terms of its operational and decontamination standing;
- Reference to the procedures used for calibration or maintenance as well as the procedural results and/or description;
- Name of person(s) using the equipment and a brief description of the nature of the work; and,
- Calibration log forms used to record all on-site calibrations.

6.3 HEALTH AND SAFETY LOG

A daily health and safety (air monitoring) log will be maintained by the Site Health and Safety Officer. Copies of this log will be submitted to the USATHAMA COR at the end of each week of field activities. At a minimum, the following information will be entered into the health and safety log:

- Signature of the person making the entry;
- Date of entry;

- Description of the field work being conducted;
- Any changes in operation;
- Names of all personnel working at the site;
- Types of air monitoring equipment being used and how it was calibrated;
- Air monitoring results;
- Level of personal protective equipment being worn;
- Description of any accidents or injuries;
- Description of any unusual occurrences or complaints.

6.4 FIELD DATA FORMS

Along with the completion of data entry in each of the above-mentioned log books, field data forms will also be completed and filed in a 3-ring notebook maintained at the sampling site for all field activities.

A boring-log form will be completed for each soil boring and well. An example boring-log form is shown in Figure 4-1. The information required for the boring log will be entered directly in the field by the geologist at the site. This information may be duplicated in the field log book at the geologists' discretion, but the original data entry will be on the boring-log form. Original boring logs will be submitted to USATHAMA, with copies submitted to FWDA and retained for the Contractor.

Other forms will also be filled out using data collected in the field. Whenever practical, these forms will be completed in the field by the personnel who originally recorded the information on the boring log or field log book. These forms include a well construction diagram as shown in Figure 4-2 and the chain-of-custody and IRDMIS data entry forms discussed in Section 6.8.

6.5 PHOTOGRAPHS

Various on-site activities and sampling specifics will be documented in color photographs as deemed necessary. Examples of items that may require such photographic documentation include:

- General site topography;
- Well drilling locations;
- Exact sample locations, (i.e., point sampled in streams, ponds, test-pits, etc.);

- Contents of split-spoons or corings if recovered material seems unusual; and,
- Well-development water following well completion.

The Contractor will obtain clearance from the Base Contact prior to using any photographic equipment on site. All photographs that are taken on site will be described in the field log book, such description to include the following:

- Film identification and frame number;
- Time and location of photograph;
- Direction the camera was pointing when the photo was taken;
- Description of what was photographed;
- Name of photographer and anyone appearing in the photo.

6.6 MATERIALS CERTIFICATION

Documentation concerning the quality of all materials used on site will be retained on site for the duration of the EI program at FWDA. The following list of documentation for materials certification serves as an example:

- Sieve analysis of sand pack material for monitoring wells;
- Sample and manufacturers certification of bentonite used for grout in monitoring wells and to seal borings;
- Sample and manufacturers certification of cement (Type II or V) used for grout in monitoring wells;
- Manufacturer and lot number for calibration standards;
- Labels from materials used for well construction; and,
- Certificates of cleaning or decontamination furnished by the laboratory (the certificate will detail the cleaning procedure).

Documentation and samples of the materials used in well construction and decontamination procedures will be archived for future reference. Material samples are required for sand pack material, bentonite, and grout used during the site investigation. These materials will be sampled and labeled in a fashion similar to that described for the environmental and field QC samples. Approximately two pounds of dry material will be required per sample.

The archived samples will be stored in clean containers and protected from exposure to the elements for the duration of the site investigation. The Project Manager in contact with the USATHAMA COR will determine the length of time material blanks are to be stored following completion of the site investigation.

6.7 VARIANCES

A variance is a deviation from project requirements. All variances from procedural, planning, and design documents, and other project requirements, will be documented in a Field Change Request/Documentation Form, shown in Figure 6-1. The USATHAMA COR will approve field changes that have a major impact on cost, schedule, and/or technical performance prior to incorporation.

Field changes and deviations from project planning documents will be reviewed and approved by the Project Manager or Project Quality Assurance Officer. All deviations from procedural and planning documents will be recorded in the field log book. Project reports will detail all field changes and deviations.

6.8 IRDMIS

Field data will be entered into the USATHAMA IRDMIS software system, which is described in the Project Management Plan (PMP). These data will be transferred from field log books and boring logs, as appropriate, onto the IRDMIS data forms described in Section 6 and then entered into the PC-based IRDMIS data entry system. The transfer of data from original data sources (field log books and boring logs) will be done in the field whenever practical as described above. In addition, data entry may occur in the field if appropriate computer hardware and qualified personnel are available. If data entry does not occur in the field, copies of the data forms and field log books will be sent to the Contractors office for prompt data entry. Once the data are in the PC-based system and have been checked for accuracy, they will be uploaded to the USATHAMA mainframe. Specific procedures for data entry in the IRDMIS system are discussed in the DMP.

FIELD CHANGE REQUEST/DOCUMENTATION FORM

Change Number ____

SITE *Fort Wingate Depot Activity* ______________________________

____

CHANGE REQUESTED ______________________________

____

____

____

____

REASON FOR CHANGE ______________________________

____

____

____

____

IMPACT OF CHANGE ______________________________

____

____

____

CHANGE REQUESTED BY ______________________ DATE __________

VERBALLY NOTIFIED ______________________ DATE __________

APPROVED BY ______________________ DATE __________
Project Quality Assurance Officer

APPROVED BY ______________________ DATE __________
Project Manager

APPROVED BY (CLIENT) ______________________ DATE __________
USATHAMA Contracting Officers' Representative

Figure 6-1

Field Change Request/Documentation Form

7.0 EQUIPMENT DECONTAMINATION

The decontamination procedures outlined in this section will be used to clean sampling and other related field equipment prior to field use. All field sampling equipment will be decontaminated before each use. A sufficient quantity of field equipment and containers will be transported to the individual sites so that the investigation may be conducted without interruptions caused by the need to suspend work in order to clean equipment.

A 40 x 40-foot decontamination pad with lined berms and a sump will be constructed prior to any sampling or drilling activities. All equipment decontamination will occur at this pad, which will be large enough to hold an entire drill rig. Water from the sump will be collected and handled as described in Section 8.2

All equipment involved in "Contamination Zone" activities will be decontaminated prior to leaving FWDA and in between sample locations. Heavy equipment (i.e., vehicles and large power tools) and light equipment (i.e., hand tools and sampling equipment) will be steam cleaned and scrubbed to remove visible soil.

7.1 CLEANING MATERIALS AND WATER

Caution will be exercised by all personnel and all applicable safety procedures will be followed in the handling of materials and water used during decontamination procedures. At a minimum, the following precautions will be taken by field personnel during these cleaning operations:

- Safety glasses with splash shields or goggles, neoprene gloves, and a neoprene laboratory apron or poly-coated Tyvek will be worn during all cleaning operations.

- No eating, smoking, drinking, chewing, or any hand-to-mouth contact shall be permitted during cleaning operations.

For the decontamination of sampling equipment, steam cleaning will be used. No detergents or solvents will be used to prevent possible sample contamination by these chemicals. Water for use in decontamination will be obtained from the pre-approved source on site. Natural bristle brushes will be used whenever possible to scrub equipment during decontamination.

The effectiveness of field or laboratory cleaning procedures will be monitored by rinsing field-cleaned equipment with USATHAMA approved water, collecting the rinsate in standard sampling containers, and submitting the rinse water to the laboratory for analysis as equipment blanks as specified in the QAPP. Any time that equipment is cleaned in the field, at least one such quality control sample will be collected per day of decontamination activities.

7.2 CLEANING PROCEDURES

Teflon and stainless steel equipment used for sample collection will be cleaned as follows:

1. Wash the equipment thoroughly with water using a brush to remove any particulate matter or surface film.
2. Rinse the equipment thoroughly with water.
3. Clean the equipment with steam from a steam cleaner and allow it to air dry and cool.
4. Wrap the equipment in aluminum foil to prevent contamination during storage and/or transport to the field.

Well sounders and tapes used to measure groundwater levels will be cleaned as follows:

1. Wash the equipment with water and a brush.
2. Rinse the equipment thoroughly with water.
3. Steam clean the equipment and allow it to dry and cool.
4. Place the equipment in a polyethylene bag or wrap it completely in aluminum foil to prevent contamination during storage and or transport to the field.

All vehicles will be thoroughly cleaned, both interior and exterior, at the conclusion of each field trip. At a minimum, this decontamination procedure will consist of washing the exterior of the vehicle with detergent, rinsing it with water, and vacuuming the interior.

[illegible] DRAFT

[illegible] equipment [illegible] decontamination [illegible]

[illegible] CONTROLS

[illegible] decontaminating [illegible]

1. Wash the equipment thoroughly [illegible]

2. Rinse the equipment [illegible]

3. [illegible]

4. When the equipment [illegible] field.

[illegible]

1. Scrub the equipment with water and a brush.

2. Rinse the equipment [illegible] water.

3. [illegible] allow it to dry [illegible].

4. [illegible] field.

[illegible]

[illegible]