State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous & Radioactive Materials Bureau
2044 Galisteo
P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-1557
Fax (505) 827-1544

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

Copy original sent to Facility

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

February 4, 1997

Howard E. Moffitt
Deputy Base Civil Engineer
49 CES\CEV
550 Tabosa Ave
Holloman Air Force Base, N.M. 88330-8458

SUBJECT: RCRA Permit for Open Detonation Treatment Unit
EPA I.D. Number NM6572124422

Dear Mr. Moffitt:

Enclosed is the final permit, issued pursuant to the Resource Conservation and Recovery Act (**RCRA**), as amended (42 USC 6901, et seq.) and the New Mexico Hazardous Waste Act (Section 74-4-1 et seq., Repl. Pamh. 1993). This Permit, Number NM6572124422-OD authorizes treatment by Open Detonation at a hazardous waste Treatment Unit at Holloman Air Force Base (**HAFB**). Your compliance with the conditions of this permit constitutes compliance with hazardous waste regulations for hazardous waste management for the duration of this permit, unless modified, suspended or revoked.

The effective date of this permit is thirty days from the date of my signature.

A Public Notice of the draft permit and public comment period was issued on June 5, 1996 and ran through July 20, 1996. The only comments that the New Mexico Environment Department, Hazardous and Radioactive Materials Bureau (HRMB) received were those submitted by Holloman Air Force Base. The Department's response to these comments is also enclosed, along with changes made in the permit text as a consequence of the comments.

Please contact Robert S. (Stu) Dinwiddie, Jerry Bober or Cornelius Amindyas at 827-1561 if you have any questions on the Permit.

Sincerely,

Ed Kelley

Ed Kelley, Ph.D., Director
Water and Waste Management Division

Enclosure

cc: Benito J. Garcia, Chief, HRMB, w/o encl.
David Neleigh, EPA (6PD-N), w/enclosure
Robert S. (Stu) Dinwiddie, PM, HRMB, w/o encl.
Files: Red 97 and Reading 97

HAZARDOUS WASTE FACILITY PERMIT

COPY
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Permittee: U.S. Department of the Air Force
Holloman Air Force Base

Identification Number: NM6572124422
Permit Number: NM6572124422-OD

Pursuant to the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6901, et seq.), and the New Mexico Hazardous Waste Act, NMSA 1978, Sections 74-4-1 et seq. Repl. Pamph. 1993), and regulations promulgated thereunder by the New Mexico Environmental Improvement Board (codified and to be codified in the Hazardous Waste Management Regulations [20 NMAC 4.1]), a Permit is issued to Holloman Air Force Base to operate a hazardous waste Open Detonation Treatment Unit, located 13 miles northwest of the City of Alamogordo, in Otero County, southcentral New Mexico on Latitude 33.010 North, and Longitude 106.091 West.

The Permittee must comply with all terms and conditions of this Permit. This Permit consists of the conditions herein including those in the Attachments. Applicable provisions of regulations cited are those which are in effect on the effective date of this permit, New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1 (Effective November 30, 1995).

This Permit is based on the assumption that all information contained in the Permit Application and the administrative record is accurate and that the facility will be constructed and operated as specified in the application. The permit application consists of information submitted in December, 1995 and supplementary technical documents.

Any inaccuracies found in the submitted information may be grounds for the termination, or modification of this Permit in accordance with 20 NMAC 4.1, Subpart IX, 40 CFR §270.41, §270.42, and §270.43 and for potential enforcement action.

This Permit shall become effective thirty days from the date of signature by the Secretary or Designee, and shall remain in effect for ten (10) years in accordance with the New Mexico Hazardous Waste Act, Section 74-4-4 unless modified, suspended or revoked under Section 74-4-4.2 or 20 NMAC 4.1, Subpart IX, 40 CFR §270.41, §270.42, §270.43, or continued in accordance with 20 NMAC 4.1, Subpart IX, 40 CFR §270.51, or issued for a duration that is less than the full allowable term in accordance with 20 NMAC 4.1, Subpart IX, 40 CFR §270.50(c).

Signed this 3rd day of February, 1997.

by E. Kelley

Ed Kelley, Ph.D, Director
Water and Waste Management Division
New Mexico Environment Department

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NEW MEXICO ENVIRONMENT DEPARTMENT (NMED) RESPONSE TO COMMENTS RECEIVED ON THE HOLLOMAN AIR FORCE BASE OPEN DETONATION TREATMENT UNIT DRAFT PERMIT

EPA ID Number: NM6572124422-OD

The Public Comment Period Began on June 5, 1996 and ended on July 20, 1996. The only comments NMED received were those submitted by Holloman Air Force Base (**HAFB**).

NOTE: Changes made in the draft Permit due to Public Comments are indicated as follows: shaded areas indicate added material, ~~strikeouts~~ indicate deleted material. This will assist the reader in rapid identification of the changes that were made.

COMMENT # 1

Module I, Page 8 of 12, Permit Condition E.12, Certification of Construction or Modification

The language states that operations at the unit may not commence until the appropriate certification by the permittee and NMED inspection or waiver of inspection has occurred. The unit is already in operation and has been for several years. The permit language should be revised to reflect the current operational status and should state that since this unit is operational, a certification letter is not needed.

HRMB RESPONSE

HRMB understands that the OD unit is already operating under interim status. However, the Permit Condition mentioned in Comment # 1, still applies to the second half of the title "Certification of Construction or Modification". Therefore the language in Permit Condition E.12, Module I, has been retained.

Permit Modification: None.

COMMENT # 2:

Module II, Page 1 of 8, Permit Condition C. General Waste Analysis.

The draft permit specifies soil sampling to a depth of 10 feet during collection of background samples. We believe this sampling to be unnecessary since operational soil sampling will only be from the upper six inches of soil at the unit and it is not feasible or reasonable to compare samples from a 6 inch depth with samples from 10 foot depth. We request that the sampling to a depth of 10 feet be deleted from the permit.

HRMB RESPONSE

HRMB agrees with the explanation that background soil samples will be taken from a depth of six inches, rather than ten (10) feet. Therefore the changes requested in Comment # 2 have been made to the permit text.

Permit Modification

The second sentence of Permit Condition C, Module II, page 1 of 8 has been revised as follows:

In addition to the proposed soil sampling within and near the OD treatment unit (described in Permit Attachments A and J), the

Permittee shall sample to at least 100 feet in radius and to a depth of ~~10 feet~~ six (6) inches below ground surface, from the perimeter of the OD treatment unit during initial soil sampling.

COMMENT # 3:

Module II, Page 2 of 8, General Waste Analysis

The last paragraph of this section, on Page 2, states that "The Permittee shall verify the analysis of each waste stream annually as part of its quality assurance program....." The paragraph continues in such a way that it appears the waste stream must be analyzed annually. Section D (Waste Analysis Plan) in Permit Module III, Page 3 of 7, specifies that because of the inherent hazardous nature of the explosive waste munitions, pre-detonation waste analysis does not have to be conducted, rather the Permittee shall use generator knowledge to characterize
the waste. Permit Module II (Section C, Page 2 of 8) appears to conflict with Permit Module III; we, therefore, request that the aforementioned section be modified to be consistent with the fact that pre-detonation waste analysis is unnecessary.

HRMB RESPONSE

Since HAFB will be conducting post detonation soil sampling, (and not pre-detonation waste stream sampling) each quarter following the last detonation event of a given quarter, the language in the last paragraph of II, mentioned in Comment # 3 has been revised.

Permit Modification:

The second paragraph on page 2, Module II, Permit Condition C has been revised as follows:

The Permittee shall verify the analysis of each post-detonation soil sample ~~waste stream annually~~ following each quarterly open detonation event as part of its quality assurance program, in accordance with "The EPA Methods for Evaluating Solid waste: Physical/Chemical Methods, EPA Publication SW-846," or equivalent methods approved by the Secretary.

COMMENT # 4:

Module II, Page 2 of 8, Permit Condition D, Security Plan (Barriers and Means to Control Entry)

The draft permit requires that Holloman construct and maintain a three-strand barbed-wire fence around the OD area and that a lockable gate be included at the entrance road.

Based on discussions with Cornelius Amindyas of HRMB, during his inspection on 10 June 1996, Holloman will construct one three-strand barbed-wire fence but does not need to construct a lockable gate at the site because of the extreme remoteness of the unit and the strict access control provided by the High Speed Test Track.

HRMB RESPONSE

HRMB agrees with the explanation given in Comment # 5, and the need for HAFB not to construct a lockable gate at the OD unit. This is because of the presence of the fence bordering HAFB and white Sands Missile Range, which is located less than 300 meters to the west and north of the center of the OD unit.

Permit Modification

Module II, Paragraph 5, Permit Condition D., page 2 of 8 has been revised as follows:

A three-strand barbed-wire fence shall be built around the OD area to prevent unauthorized personnel and wild life from gaining access to the OD unit. ~~The roadway barrier (i.e., a lockable gate) to the OD area shall be kept locked except when Ordnance Disposal personnel enter the area for inspections or treatment operations.~~ Access to the open detonation unit shall be only through ~~one gate, which is to be kept locked at all times.~~ the current roadway barrier that is manned by HAFB armed security guards. This will serve to prevent access to the OD treatment unit by unauthorized personnel.

COMMENT # 5

Module II, Page 4 of 8, Permit Condition H, Preparedness and Prevention (H.1 Required Equipment)

The permit language currently specifies that ".....the Permittee shall maintain at the facility the equipment set forth in the Contingency Plan....." Holloman's interpretation of the word "facility" (as defined in Permit Module I, D.1 Facility, Page 3) is the OD unit itself and no other part of Holloman AFB. The equipment specified in the Contingency Plan is brought to the OD unit at the time of the waste treatment and then is taken back to the Explosive Ordnance Disposal (EOD) team office until the next treatment event. There is no equipment storage facility at the OD treatment unit. Holloman would like to revise the permit language to reflect that the equipment will be maintained at the EOD office until such time that a treatment event occurs, when the equipment is transported to the site.

HRMB RESPONSE

Since there is no bunker at the open detonation unit, and the word "Facility" means the whole complex including the OD unit, the changes requested in Comment # 5 have been made to the permit text.

Permit Modification

Module II, Page 4 of 8, Permit Condition H.1 has been revised as follows:

H.1. Required Equipment

At a minimum, the Permittee shall maintain at the ~~facility~~ EOD Team Office the equipment set forth in the Contingency Plan, Permit Attachment E, as required by 20 NMAC 4.1, Subpart V, §264.32.

COMMENT # 6

Module III, Page 1 of 7, Permit Condition B, Permitted and Prohibited Waste Identification

In subsection B.1, in the second line, "Permit Attachment M" should be changed to "Permit Attachment N" since Attachment N is the Part A and Attachment M is a discussion of air modeling and air quality.

HRMB RESPONSE

The typographic error observed in Comment # 6 has been corrected.

Permit Module III, Page 1 of 7, Permit Condition B.1, Permitted and Prohibited Waste Identification has been revised as follows:

B.1. The Permittee may Open Detonate only the wastes listed in Permit Attachment ~~M~~ N (i.e., EPA Part A Hazardous Waste Permit Application: Permitted Waste Codes and Maximum Treatment Quantities) and in Permit Attachment A, Waste Analysis Plan. The Permittee is prohibited from treating Radioactive Nuclear Waste, Mixed Waste, and Polychlorinated Biphenyls (**PCBs**). All treatment shall consist of explosive Open Detonation only.

COMMENT # 7

Module III, Page 1 of 7, Permit Condition B.2, Permitted and Prohibited Waste Identification

In subsection B.2, the annual and 10 year permit life amount of waste (NEW) that can be treated is specified as 240,000 pounds and 2,400,000 pounds, respectively. The Part A to the permit application requested 450,000 pounds of NEW per year or 4,500,000 pounds for the 10 year permit. Holloman requests that 450,000 pounds NEW be allowed annually.

HRMB RESPONSE

The changes requested in Comment # 7 have been made for the annual amount of waste munitions treated to be consistent with the amount given in Part A, permit application, which is contained in Permit Attachment N.

Permit Modification

Permit Module III, Page 1 of 7, the second sentence of Permit Condition B.2 has been revised as follows:

The amount of waste munitions to be open detonated shall not exceed ~~240,000~~ 450,000 pounds Net Explosive Weight (NEW) per calendar year or ~~2,400,000~~ 4,500,000 pounds NEW for the permitted life of the OD Treatment Unit.

COMMENT # 8

Module III, Page 2 of 7, Permit Condition C, Open Detonation on the Ground

In subsections C.2 through C.6, the language refers to operation, maintenance, design, and construction of "Open Detonation pits" as if these pits are engineered excavations. Since "pits" are depressions created by the explosions and not engineered structures, Holloman requests that "Open Detonation pits" in these subsections be replaced with "OD Treatment Unit."

HRMB RESPONSE

The changes requested in Comment # 8 have been made in Permit Conditions C.1, C.3 and C.4. Permit Conditions C.2, C.5 and C.6 have been retained as necessary Permit requirements.

Permit Modification

Permit Module III, Page 2 of 7, Permit Conditions C.1, C.3 and C.4 have been revised as follows:

C. <u>OPEN DETONATION ON THE GROUND</u>:

C.1. The Permittee shall ~~construct,~~ maintain and operate the OD Treatment Unit to minimize the possibility of a ~~accidental~~ fire, explosion, or any unplanned, sudden or nonsudden release of hazardous waste constituents to air, soil, or surface water which could threaten human health or the environment, as required by 20 NMAC 4.1, Subpart V, § 264.31 and §264.601...

C.3. The Permittee shall ~~design, construct,~~ operate and maintain the Open Detonation pit in order to minimize air emissions or exposure of people (on-site or off-site) to toxic or hazardous emissions as described in Permit Attachment M.

C.4. The Permittee shall ~~construct,~~ operate and maintain the Open Detonation pit in order to minimize noise.

COMMENT # 9:

Module III, Page 2 of 7, Permit Condition C, Open Detonation on the Ground

In subsections C.7 and C.8, the permit refers to run-on and run-off control consisting of a berm. Based on discussions with Cornelius Amindyas during his inspection on June 10, 1996, Holloman will construct a two-foot high earthen berm that connects into a natural topographic high that forms a natural berm around the site on the west and north sides of the unit. This combination of constructed berm and natural topographic high will prevent run-on into the OD treatment area (100 foot radius in center of unit) and runoff from the treatment zone to the outer portions of the unit. Holloman requests language in the permit that reflects the usage of existing natural conditions to aid in run-on and run-off control.

HRMB RESPONSE

HRMB understands that a 2 feet high natural berm exists on the west and north sides of the OD unit, but requires that HAFB construct and maintain a 2 feet high berm on the eastern and southern sides of the OD unit to prevent the run-on into the OD

unit, and run-off from the treatment unit to outer portions of the OD unit.

Permit Modification

Permit Module III, Page 2 of 7, Permit Conditions C.7 and C.8 have been revised as follows:

C.7. The Permittee shall ~~design~~, construct, operate and maintain run-off control systems in accordance with the ~~design plans,~~ specifications, and operating practices which are described in permit attachments G.

C.8. The Permittee ~~must~~ shall construct protective berms at least 2 feet high on the east and south sides of the OD unit to complement the natural berms that exist on the north and west sides of the pit. These berms ~~which~~ shall be maintained in such a way that surface drainage will be eliminated from entering the active portion of the OD pit created ~~excavated~~ ~~OD~~ open detonation activities, in accordance with [20 NMAC 4.1, Subpart V, §264.301(g)].

COMMENT # 10

Module III, Page 3 of 7, Permit Condition C, Open Detonation on the Ground

In subsection C.9, the permit language specifies that "..... the Permittee shall not allow accumulated precipitation in any portion of the OD pit. All standing water shall be removed within 24 hours after a precipitation event." Again, the reference to "OD pit" should be revised to "OD Treatment Unit" so it does not appear that detonation depressions are engineered structures. Since it is highly unlikely that standing water would ever be a concern at this location, Holloman would like to have this permit condition removed. Daily inspections are not conducted at the site and the EOD office is at such a distance from the treatment unit that it is difficult to determine if rain at the EOD office means it is raining at the treatment unit. The condition is very onerous for EOD personnel.

HRMB RESPONSE

The reference to OD pit has been revised to explain that the pit was created by open detonation activities. All other parts of the subject Permit Conditions were retained to be consistent with NMED's requirement for all facilities conducting open detonation activities in New Mexico.

Permit modification

Permit Module III, Page 3 of 7, first sentence of Permit Condition C.9 has been revised as follows:

The Permittee shall not allow accumulated precipitation in any portion of the OD pit created by open detonation activities.

COMMENT # 11

Module III, Page 4 of 7, Permit Condition F, Inspection Schedules and Procedures

Unexploded ordinance (UXO) or any casings or fragments with possible UXO are redetonated immediately after initial post-detonation inspections. When there is no more UXO then the casings and fragments are placed in appropriate containers. UXO is not placed in containers. Also, lead is not recycled as is currently stated in the draft permit. Holloman requests a revision of the permit language to reflect this operational condition.

HRMB RESPONSE

The changes requested in Comment # 11 have been made to reflect the operational condition at HAFB the OD treatment unit.

Permit Modification

Permit Module III, Page 4 of 7, Permit Condition F has been revised as follows:

F. <u>INSPECTION SCHEDULES AND PROCEDURES:</u>

The Permittee shall inspect the OD Treatment Unit in accordance with the inspection Schedule presented in Permit Attachment C. These inspections shall also include search for, and the collection of any unexploded ordnance (**UXO**), metal casings, and related "kickouts". The collected UXOs shall be redetonated immediately after the initial post-detonation operation. All UXO casings, metal casings and fragments shall be placed in appropriate containers, and handled as RCRA hazardous waste. Recovered lead fragments shall also be ~~recycled as appropriate~~ containerized and handled as hazardous waste.

COMMENT # 12

Module III, Page 4 of 7, Permit Condition I, Sampling and Analysis for Air and Soil Monitoring

In subsections I.1 and I.2, the permit refers to evaluating the potential impact of air pollutants at the site and then specifies that air monitoring will be conducted when soil sampling indicates the potential of hazardous waste constituents impacting groundwater. Holloman AFB is requesting an exemption from air monitoring because the air modeling performed for the permit application used worst-case assumptions and showed that no impacts would be seen at off-site receptors above the ambient air quality standards. Although other facilities in New Mexico have these air monitoring requirements in their permits, Holloman AFB is different from these other sites in three respects. The site is extremely remote from any off-site or sensitive receptors, and emissions from the OD unit have little or no impact on these receptors. Secondly, unlike other New Mexico DOD facilities, Holloman AFB is not in or near a non-attainment area for any pollutant. Because Holloman AFB is in an attainment area for all pollutants, monitoring of air emissions from the OD Unit is not as critical an issue as it is for bases that are in non-attainment areas. Lastly, the logistics of establishing air monitoring stations that would be close enough to the OD Unit to obtain meaningful data are difficult and costly. For example, fragments of casing could impact the monitoring station during explosions, thus resulting in high costs and loss of data.

HRMB RESPONSE

NMED cannot waive the requirement for Holloman Air Force Base (**HAFB**) to conduct air monitoring when soil sampling results indicate the potential for hazardous constituents from OD activities to impact ground water. Firstly, this is because HAFB plans to detonate up to 450,000 pounds net explosive weight (**NEW**) per calendar year. This amount is nearly 5 times the largest amount of waste munitions that a recently permitted DOD facility will be detonating per calendar year, and 45 times the smallest amount that another currently active DOD facility will be treating per calendar year. Secondly, the depth to the water table at HAFB varies from 27 to 31 feet below ground surface (**BGS**). At the other DOD facilities that have OD treatment units, the depth to the water table varies from 100 feet BGS (shallowest) to 600 feet BGS (deepest). All the other DOD facilities, irrespective of location are required to conduct air monitoring, when soil sampling results indicate the potential for hazardous constituents to impact ground water. Therefore, in order to be consistent with NMED's requirement for other permitted DOD facilities in New Mexico, HRMB retained the permit Conditions mentioned in Comment # 12.

Permit Modification: None

COMMENT # 13

Module III, Page 5 of 7, Permit Condition, I, Sampling and Analysis for Air and Soil Monitoring

In subsection I.4, the permit specifies that quarterly soil monitoring shall be conducted within 24 hours after the last quarterly open detonation event. It is logistically difficult to conduct sampling within 24 hours since the sampling has to be preceded by inspection and removal actions that also have to be conducted within 24 hours (see Permit Module III, Section L.2, Page 6 of 7). With these conditions, it is probable that the site will not be ready for sampling within 24 hours of the last detonation event. Holloman AFB suggests that 72 hours be used as the time frame for soil sampling. This will provide opportunity for EOD to conduct inspection and removal actions within its 24 hour limit and then inform the Environmental Flight that the area is clear for the sampling team. Holloman Air Force Base will ensure that no backfilling or other dirtwork is performed before sampling occurs.

HRMB RESPONSE

The changes requested in Comment # 13 have been made based upon the explanation given in the same Comment.

Permit Modification

Module III, Page 5 of 7, Permit Condition, I, and Page 6 of 7, Permit Condition L.2 have been revised as follows:

I.4. The Permittee shall carry out quarterly soil sampling within ~~24~~ 72 hours after the last quarterly Open Detonation event. The soil sampling shall be preceded by an inspection of the OD Unit and removal of any unexploded ordnance by trained Ordnance Disposal personnel.

L.2. Within ~~24~~ 72 hours after each treatment event, Ordnance Disposal personnel shall police the cleared area within the fence surrounding the OD Unit for fragments of waste (including metal casings) originating from treatment operations, and "kickouts".

COMMENT # 14

Module III, Page 6 of 7, Permit Condition K, Record keeping

The permit specifies that records shall be maintained at the OD Treatment Unit. Holloman does not have structural facilities to store records at the treatment facility itself. Records are maintained at the EOD office, approximately 25 miles to the south of the treatment unit. Holloman requests that the language of the permit be revised to show that records will be stored at the EOD facility on Holloman AFB.

HRMB RESPONSE

Based upon the lack of a bunker at the HAFB OD unit (corroborated by Mr. Cornelius Amindyas during his visit to the site on June 10, 1996), and the explanation given in Comment # 14, the changes requested in Comment # 14 have been made.

Permit Modification

Module III, Page 6 of 7, Permit Condition K has been revised as follows:

K. <u>RECORDKEEPING</u>

The Permittee shall develop and maintain all records at the ~~OD Treatment Unit~~ EOD Office on HAFB, as required by 20 NMAC 4.1, Subpart V, §264.73, and §264.602, as contained in Permit Attachment L.

COMMENT # 15

Module III, Page 6 of 7, Permit Condition N, Air Modeling and Monitoring

As explained in item 12 of this letter, Holloman requests a waiver from air modeling, and monitoring.

HRMB RESPONSE

By virtue of the large amount of waste munitions that HAFB plans to demolish per calendar year (450,000 pounds NEW), and also because the ground water table at the OD unit is only 27 feet below the ground surface, NMED decided to retain the Permit Condition mentioned in Comment # 15.

Permit Modification: None.

COMMENT # 16

Permit Attachment A, Page 6 of 22:

Lines 4,5,7, and 8 of the first paragraph refer to temperatures in degrees "A" instead of "C." Line 11 of the second paragraph on that same page should also be changed.

HRMB RESPONSE

The typographic mentioned in Comment # 16 have been corrected.

Permit Modification

Lines 4 through 8, of paragraph 1, and line 11 of the second paragraph, in Permit Attachment A, page 6, have been revised as follows:

> Nitroglycerin has bee discussed previously in conjunction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately ~~13°A~~ 13°C. The specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at ~~20°A~~ 20°C. Nitroglycerin decomposes with gas evolution at temperatures of ~~145°A~~ 145°C. The published explosion temperature for nitroglycerin is 222°C, with evolution of approximately 368 Kcal/mol of heat and 715 mL of gas per gram of charge.
>
> The explosive temperature for cellulose nitrate is approximately ~~230°A~~ 230°C with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal/mol of heat upon detonation that is accompanied by evolution of approximately 700 mL of gas per gram charge.

COMMENT # 17

Permit Attachment A, Page 22 of 22

In the last paragraph, second line, soil samples will be taken "quarterly" not "annually."

HRMB RESPONSE

The typographic error mentioned in Comment # 17 has been corrected.

Permit modification

The first sentence of the second paragraph, second line on page 22 of 22, Permit Attachment A, has been revised as follows:

Samples of the treatment residuals and underlying soils will be taken ~~annually~~ quarterly to demonstrate the effectiveness of the treatment and to ensure that hazardous wastes are not present.

COMMENT # 18

Permit Attachment B, Page 1 of 3, 24-Hour Surveillance System

In the first sentence of the third paragraph, "B-4" should be changed to "F-4" and "B-117A" should be changed to "F-117A."

HRMB RESPONSE

The typographic errors stated in Comment # 18 have been corrected.

Permit Modification

The first sentence of the third paragraph on Page 1 of 3, Permit Attachment b has been revised as follows:

The primary mission of Holloman AFB is to provide upgrade and continuation training for air crews assigned to T38, ~~B-4~~, F-4 and ~~B-117A~~ F-117A aircraft.

COMMENT # 19

Permit Attachment B, Page 2 of 3

In the first full paragraph on this page, a second three-strand barbed-wire fence is referred to as separating the OD Treatment Unit from the remainder of the area surrounding the OD area. Based on discussions with Cornelius Amindyas during his 10 June 1996 inspection, this second barbed-wire fence is not necessary. Holloman AFB would like this permit condition taken out of the permit.

HRMB RESPONSE

Following Mr. Amindyas' visit to the HAFB OD unit, HRMB understood that the peripheral fence surrounding the OD unit would serve the purpose of keeping out any unauthorized personnel, as well as wild life from the OD treatment unit. A second fence is therefore redundant.

Permit Modification

The second sentence of the first full paragraph of Permit Attachment B, Page 2 of 3 has been deleted as follows:

The OD Treatment Unit is a restricted-access area, with the entire area boundary fenced and posted with warning signs at 400 feet intervals. ~~A second three strand barbed wire fence separates the OD Treatment Unit from the remainder of the area surrounding the OD area, in compliance with 20 NMAC 4.1, Subpart V, 40 CFR, §264.14(b)(2).~~

COMMENT # 20

Permit Attachment B, Page 2 of 3, Warning Signs

The last sentence of this section specifies that daily inspections will be conducted and recorded. The inspection schedule for signs as specified in Permit Attachment C (Table C-1, Page 3 of 4) is monthly. Holloman requests that the permit consistently specify monthly inspections of the signs. Also, "HAFB Security Directorate" should be revised to "HAFB Security Police." Directorate is an Army term, not an Air Force term.

HRMB RESPONSE

The changes requested in Comment # 20 have been made as requested, in order to be consistent with the inspection schedule of Table C-1, Permit Attachment C.

Permit Modification

The last sentence of the third paragraph on Page 2 of 3, Permit Attachment B has been revised as follows:

~~Daily~~ Monthly security inspections will be conducted and recorded by the HAFB Security ~~Directorate~~ Police.

COMMENT # 21

Permit Attachment D

A general comment is that training of EOD personnel is conducted at Indian Head Naval Ordnance Station, Indian Head, MD rather than Indian Dead Naval Ordnance Station, Indian Dead, MD. The term Indian Dead is used in numerous places throughout the Attachment.

HRMB RESPONSE

The typographic error mentioned in Comment # 21 has been corrected globally in the entire Permit Attachment D by replacing Indian ~~Dead~~ Maryland with Indian Head Maryland.

COMMENT # 22

Permit Attachment E, Page 5 of 15

In the first line on this page, there appears to be a reference to a table (and the table itself) missing based on the permit application. The permit text appears as "Response Plan, included in below." The permit application text for that portion of the sentence is "Response Plan, included in Exhibit G-1 below."

HRMB RESPONSE

The third sentence of the paragraph titled "Emergency Response Equipment", which starts at the bottom of page 4 of 15, Permit Attachment E, has been revised as shown in the next paragraph.

Permit Modification

The first complete sentence at the top of Page 5 of 15, Permit Attachment E, has been revised as follows:

A listing of the equipment that is available, numbers of items, and the locations of that equipment are included in the ~~Contingency Response Plan, included in below~~ remainder of this Contingency Plan that begins from "Contingency Response Plan" which is presented below.

COMMENT # 23

Permit Attachment F, Page 1 of 10, Summary of Activities Conducted During Active Life

The seventh line from the top specifies "annual" sampling and should be changed to "quarterly."

HRMB RESPONSE

The changes requested in Comment # 23 have been made in order to make the sampling frequency consistent with the sampling frequency contained in Permit Attachment J, (Sampling and Analysis Plan).

Permit Modification

The third sentence in the last paragraph of Permit Attachment F, Page 1 of 10 has been revised as follows:

~~Annually~~ Quarterly, residuals and soils will be sampled for characteristics of hazardous waste and suspected hazardous constituents, as specified in the Sampling and Analysis Plan **(SAP)**, Permit Attachment J.

COMMENT # 24

Permit Attachment G, Page 4 of 15

The third paragraph on this page refers to 240,000 pounds of NEW treated per year; as explained in Comment # 7 of this letter, Holloman requests that 450,000 pounds NEW be the annual limit.

HRMB RESPONSE

HRMB agrees with the explanation and suggestion given in Comment # 24 and has made the changes requested, in order to be consistent with the amount of waste munitions to be treated by KAFB given in Part a permit application.

Permit modification

The fourth sentence of paragraph 3, page 4 of 15, Permit Attachment G has been revised as follows:

Although the precise number of treatment occurrences during any year is variable, discrete treatment events will occur at typical frequencies of at least one event per month, giving a total of ~~240,000~~ 450,000 pounds NEW per calendar year.

COMMENT # 25

Permit Attachment G, Page 4 of 15

The fourth paragraph on this page, fifth sentence, specifies that residuals that are ejected outside of the depression are collected and returned to the depression. This sentence should read "Unexploded ordnance (UXO) that may have been ejected from the depression is collected and returned to the depression and exploded again to treat the UXO. Casings and fragments that do not have UXO are collected and containerized."

HRMB RESPONSE

The changes requested in Comment # 25 have been made as suggested.

Permit Modification

The force of the explosion often creates a depression in the ground, which is inspected to ensure that the waste has been completely destroyed. Unexploded ordnance (UXO) that may have been ejected from the depression is collected and returned to the depression and exploded again to treat the UXO. Casings and fragments that do not have UXO are collected and containerized. ~~Residuals ejected outside of the depression are collected and returned to the depression.~~

COMMENT # 26

Permit Attachment G, Page 5 of 15

The topmost continuation of the paragraph from the preceding page refers to the filling in of depressions after detonation events and makes is sound as if samples are collected after each detonation event. Starting on the last line of Page 4 of 15, Holloman requests the following language be used rather than the present language: "When the detonation area is covered with depressions, a bulldozer smooths out the site, filling in the depressions. During quarterly soil sampling, the last detonation depression is not filled in, nor is any dirtwork conducted, until the soil samples have been collected. The location of the OD unit....."

HRMB RESPONSE

The changes requested in Comment # 26 have been incorporated into the permit text as suggested.

Permit Modification

The last sentence at the bottom of Page 4 of 15, Permit Attachment G has been revised as follows:

~~When the detonation area is covered with depressions, a bulldozer smooths out the site, filling in the depressions after samples have been taken from the depression and surrounding area affected by the detonation event~~. When the detonation area is covered with depressions, a bulldozer smooths out the site, filling in the depressions. During quarterly soil sampling, the last detonation depression is not filled in, nor is any dirtwork conducted, until the soil samples have been collected.

COMMENT # 27

Permit Attachment G, Page 15 of 15, Run-on and Run-off Control

See Comment # 9 concerning the construction of a partial earthen berm that connects into an existing topographic high to form run-on and run-off controls. Holloman will construct a two-foot high earthen berm that connects into a natural topographic high that forms a natural berm around the site on the west and north sides of the unit.

HRMB RESPONSE

The changes requested in Comment # 27 have been made and incorporated into the permit text.

Permit Modification

The sixth paragraph on page 15 of 15, Permit Attachment G, has been revised as follows:

An earthen berm 2 feet high will be constructed ~~around the OD Treatment unit, at the periphery of the fence that surrounds the OD Unit~~. on the east and south sides of the OD unit to complement the natural berms that exist on the north and west sides of the pit. This berm will serve to prevent run-on from precipitation to the OD unit, and run-off of hazardous constituents from the OD unit.

COMMENT # 28

Permit Attachment J, Page 2 of 36, Background Sampling

This section (first sentence) specifies that the six background soil samples will be collected at least 700 feet outside areas potentially impacted by previous activities at the site. However, page 4 of Permit Attachment J (Sampling Location Selection) states that background soil samples will be collected at a distance between 500 and 1000 feet from the edge of the OD Unit. Holloman requests language that is consistent between the two sections and would prefer to use the distance of between 500 and 1000 feet from the OD Unit boundary rather than "at least 700 feet" from areas potentially impacted by previous activities at the site.

HRMB RESPONSE

Since the geometry of the zone not impacted by OD activities around the OD unit is not uniform, HRMB has made the changes suggested in Comment # 28.

Permit modification

The first sentence on page 2 of 36, Permit Attachment J has been revised as follows:

Prior to any routine monitoring, one round of six background soil samples will be collected at ~~least 700 feet outside areas potentially impacted by previous activities at the OD unit~~. a distance of between 500 feet and 1000 feet from the OD Unit boundary.

COMMENT # 29

Permit Attachment J, Page 24 of 36, Required Skills, Education, and Experience and Required Education

The permit specifies that the soil sampler will have two years of experience with soil sample collection and a Bachelor's degree in a relevant science or engineering field. Holloman requests that the sampler's qualifications should be at least one year's experience in environmental sampling techniques which include soil sampling methodologies. Holloman also requests that in lieu of a formal degree the sampler must have successful completion of an EPA approved Hazardous Waste Operations and Emergency response course. This course will satisfy the requirements of 29 CFR 1910.120 part (p) and/or part (q). Many sampling projects are staffed by environmental technicians that do not have formal education but do have the practical field experience and training courses that allow for the proper collection of environmental samples.

HRMB RESPONSE

HRMB understands the explanation given in Comment # 29, and has made a revision to the subject paragraph as follows:

Permit Modification

The fourth paragraph from the top of page 24 of 36, Permit Attachment J has been revised as follows:

Required Skills, Experience and Qualifications:

- ~~Two years experience with soil sample collection~~
- At least one year's experience in environmental sampling techniques which include soil sampling methodologies.

Required Education:

- ~~A Bachelor's degree in a relevant science or engineering field~~
  - At least a high school diploma and the sampler must have successfully completed an EPA approved Hazardous Waste Operations and Emergency Response Course.

COMMENT # 30

Permit Attachment K, Page 1 of 12, Air Quality Assessments (Potential for Emissions)

As explained in item 12, Holloman believes that air monitoring should not be required as specified in the second sentence of the second paragraph of this section.

HRMB RESPONSE

See HRMB Response to Comment # 12.

Permit Modification: None

COMMENT # 31

Permit Attachment K, Page 2 of 12

The first and second full sentences on the top of this page refer to features (public highway 10 miles to the west and Davis Dome) that are directly from the Ft. Bliss permit and are not applicable to the 20,000 Pound OD Unit. Therefore, these references should not be included in the 20,000 Pound OD Unit permit.

HRMB RESPONSE

This portion of the subject draft permit (i.e., Attachment K) was written concurrently with a similar Attachment in Fort Bliss' OD operational permit. HRMB regrets the confusion brought about in references to Fort Bliss in Comments # 31 to # 35.

Permit Modification

The last three sentences formerly at the top of Page 2 of 12, Permit attachment K, have been deleted as follows:

~~The nearest public highway is 10 miles (18 km) to the west. Davis Dome is the closest military occupation and it is 4 miles~~

~~(6 km) to the west. The prevailing winds are~~

~~north south and potential receptors in these directions are even more distant.~~

COMMENT # 32

Permit Attachment K, Page 3 of 12, Existing Air Quality/Other Sources/Receptors

Throughout this section there are references to operations at Ft. Bliss that do not have any relevance to the 20,000 Pound OD Unit at Holloman AFB. For example, the first paragraph of this section discusses the air quality in the vicinity of Ft. Bliss, in El Paso County and non-attainment areas. There are several references to the 41st EOD unit, which is an Army unit at Ft. Bliss rather than the EOD unit at Holloman AFB. It appears that language from the Ft. Bliss permit has been put in this section and should be deleted and replaced with more specific information for Holloman AFB. The permit language should state that the 20,000 Pound OD Unit at Holloman AFB is in an attainment area and that the surrounding air quality is good.

HRMB RESPONSE

See HRMB response to Comment # 31.

Permit Modification

Paragraphs 4 and 5 of Page 3 of 12, Permit Attachment K have been revised as follows:

~~The current air quality in the vicinity of the Fort Bliss OD treatment unit is varied. The City of El Paso, Texas in El Paso County, to the south is an air quality non-attainment area for ozone and is rated as serious. Additionally, an area in the City of El Paso is also a non-attainment area for particulate matter (PM-10) and carbon monoxide. This area is bounded on the north by Interstate Highway 10, on the south by the Rio Grande River, on the east by Avenue of the Americas, and on the west by the Executive Center. PM-10 is rated as Class I non-attainment and the carbon monoxide level is rated as moderate~~.

The air quality in Otero County, New Mexico where the subject site is located, is in compliance with air quality standards. There are no areas of non-attainment in Otero County and no major air emission sources. The 20,000 Pound OD Unit at Holloman AFB is in an attainment area and the surrounding air quality is good.

COMMENT # 33

Permit Attachment K, Page 4 of 12, Potential Exposure Pathways

This section refers to operations such as Range Control, location in a firing range impact area, target practice, and the 41st EOD unit that are not applicable to Holloman AFB. These, again, appear to be directly taken from the Ft. Bliss permit. Holloman request that language specific to the 20,000 Pound Unit be inserted in place of the Ft. Bliss language.

HRMB RESPONSE

See HRMB response to Comment # 31.

Permit Modification

The third paragraph on page 4 of 12, Permit attachment K, has been revised as follows:

POTENTIAL EXPOSURE PATHWAYS

The public is denied access to the OD treatment unit by a number of mechanisms. These include the HAFB Security Police, and the ~~(e.g., Range Control, location in a firing range impact area,~~ remoteness of the OD unit from human habitation~~)~~. Access is only provided to the ~~41st~~ HAFB EOD personnel during OD operations. No one is allowed at the OD treatment unit during ~~Range Operations~~ open detonation activities. ~~Range Operations, including target practice~~.

COMMENT # 34

Permit Attachment K, Page 4 of 12, Time Before Detonation

The first sentence refers to placement of wastes "in the appropriate treatment area
(pit)." Again, this language appears to come from the Ft. Bliss permit. At the 20,000 Pound Unit, explosive waste is places on the ground, since pits are not excavated. Holloman AFB requests that the language be revised to show that waste is not placed in a pit.

HRMB RESPONSE

See HRMB Response to Comment # 31

Permit Modification

The first sentence of the fourth paragraph on Page 4 of 12, Permit Attachment K, has been revised as follows:

Time Before Detonation

Before each OD activity, the PEP hazardous wastes are expeditiously placed in the appropriate above ground treatment area ~~(pit)~~, initiation materials are applied, and after retreat by the EOD personnel to a specified safe distance, the ignition is accomplished by remote control.

COMMENT # 35

Permit Attachment K, Page 5 of 12, Management of Waste Residues

It appears this section language that is not applicable to the 20,000 Pound OD Unit -words and phrases such as "Range," "Range operations," "ballistic aerial tests (BATS)," "large caliber slugs." These terms are not applicable to the 20,000 Pound OD Unit and appear to be more applicable to the Ft. Bliss permit. Holloman requests that language be specific to the 20,000 Pound Unit.

HRMB RESPONSE

See HRMB Response to Comment # 31.

Permit modification

The first paragraph formerly on page on Page 5 of 12, but now the fourth paragraph on page 4 of 12, Permit Attachment K, has been revised as follows:

Management of Waste Residues

The treatment unit currently has no visual indication of ash or other chemical residue. There are a few metal fragments identifiable within the OD unit.~~, and the impact area of the Range in general has remnants of Range operations [e.g., ballistic aerial tests (BATs), large caliber slugs].~~ Any metal fragments and remnants ~~of Range operations~~ resulting from OD operations will be collected after every treatment activity. The fragments so collected will be placed into appropriate containers, and handled as RCRA hazardous waste.

COMMENT # 36

Permit Attachment L, Page 1 of 12, Operating Record

The first statement under this section specifies that records will be maintained at the OD treatment unit. As explained in item 14 above, Holloman AFB keeps the records for the OD Unit at the EOD office, approximately 25 miles south of the unit. Holloman requests permit language that specifies that records are maintained at the EOD office.

HRMB RESPONSE

HRMB RESPONSE

Based upon the lack of a bunker or any structures at the HAFB OD unit (corroborated by Mr. Cornelius Amindyas during his visit to the site on June 10, 1996), and the explanation given in Comment # 14, the changes requested in Comment # 14 have been made.

Permit Modification

The first sentence of paragraph 1, Page 1, permit attachment L has been revised as follows:

K. RECORDKEEPING

Operating record

Holloman Air Force Base will keep a written open detonation operating record of OD activities at the ~~open detonation~~ EOD Office at HAFB. The following records will be maintained at the ~~OD treatment unit~~ EOD Office at HAFB:

COMMENT # 37

Permit Attachment M, Page 2 of 12, Assessment of Air Migration Potential

The third sentence in the first paragraph of this section states that the air modeling assumed that a mass of 240,000 pounds of NEW was used annually. The modeling was actually performed using 50,000 pounds NEW annually (maximum) as stated in the Part B Permit Application (Page E-23).

HRMB RESPONSE

The typographic error mentioned in Comment # 37 has been corrected.

Permit Modification

The third sentence of the first complete paragraph on page 2 of 12, permit attachment M, has been revised as follows:

The following modeling analysis assumes that the maximum annual detonation mass is ~~240,000~~ 50,000 pounds net explosive weight (NEW) and the maximum single detonation mass is 20,000 pounds NEW.

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List of Acronyms

AAQS	Ambient Air Quality Standards
ACC	Air Combat Command
AFB	Air Force Base
AFMC	Air Force Materiel Command
AFSC	Air Force Systems Command
AQCR	Air Quality Control Regulations
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
CES	Civil Engineering Squadron
CFR	Code of Federal Regulations
COC	Chain of Custody
COMSEC	Communications Security
DDNP	Dizodinitrophenol
DQOs	Data Quality Objectives
EOD	Explosive Ordnance Demolition
FML	Flexible Membrane Liner
HMX	Cyclotetramethylenetetranintramine
HQ	Headquarters
MSL	Mean Sea Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NEW	Net Explosive Weight
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMHHS	New Mexico Human Health Standards
NMWQCCR	New Mexico Water Quality Control Commission Regulations
OD	Open Detonation
OEL	Occupational Exposure Limit
OPSEC	Operations Security
OSC	On-site Coordinator
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PETN	Pentaerythrite Tetranitrate
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plans
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenenitramine
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SVOCs	Semivolatile Organic Compounds
TAPs	Toxic Air Pollutants
TDS	Total Dissolved Solids
TNT	Trinitrotoluene
TO	Technical Order
TSD	Treatment, Storage and Disposal
USAF	United States Air Force
USEPA	U.S. Environmental Protection Agency
UTL	Upper Tolerance Limit
VOCs	Volatile Organic Compounds

MODULE I - GENERAL PERMIT CONDITIONS

A. EFFECT OF PERMIT

The Permittee is allowed to treat on-site[1] hazardous waste in accordance with the conditions of this Permit as specified in Module III, Permit Condition B of this Module, in compliance with 20 NMAC 4.1, Subpart V, 40 CFR §264, Subpart I through O. Any treatment of hazardous waste requiring a permit under the New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V and not specifically authorized in this Permit is prohibited. Subject to 20 NMAC 4.1, Subpart IX, § 270.4, compliance with this Permit generally constitutes compliance, for purposes of enforcement, with the New Mexico Hazardous Waste Act (§§ 74-4-1 et seq. NMSA 1978) and 20 NMAC 4.1, Subparts I,II, III, and IV to the extent the requirement of those Parts are applicable. The Permittee must also comply with all applicable self-implementing provisions imposed by the Resource Conservation and Recovery Act (RCRA) or 20 NMAC 4.1, Subpart VIII. A complete (RCRA) permit consists of this Permit and a U.S. EPA Permit issued under the provisions of the Hazardous and Solid Waste Amendment of 1984 (HSWA) which addresses the portion of the RCRA program for which the State is authorized. Issuance of this Permit does not convey any property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of state or local laws or regulations. Compliance with the terms of this Permit does not constitute a defense to any order issued or any action brought under Sections 3008(a), 3008(h), 3013, or 7003 of RCRA; Sections 106(a), 104 or 107 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq., commonly known as CERCLA), or any other law providing for protection of public health or the environment. [20 NMAC 4.1, Subpart IX, §§ 270.4 and 270.30(g)]

B. PERMIT ACTIONS

B.1. Permit Modification, Revocation and Reissuance, and Termination

This Permit may be modified, revoked and reissued, or terminated for cause, as specified in 20 NMAC 4.1,

[1] See Definition on page 3.

Subpart IX, §§ 270.41, 270.42, and 270.43. The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes or anticipated noncompliance on the part of the Permittee, does not stay the applicability or enforceability of any permit condition. [20 NMAC 4.1, Subpart IX, §§ 270.4(a) and 270.30(f)].

B.2. Permit Renewal

This Permit may be renewed as specified in 20 NMAC 4.1, Subpart IX, §270.30(b) and Permit Condition E.2. Review of any application for a Permit renewal shall consider improvements in the state of control and measurement technology, as well as changes in applicable regulations. [20 NMAC 4.1, Subpart IX, 40 CFR §270.30(b).

C. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit, or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby [20 NMAC 4.1, Subpart X, §1004].

D. DEFINITIONS

For purposes of this Permit, terms used herein are defined for each module. Terms found in Module I shall have the same meaning as those in 20 NMAC 4.1, Subpart I,40 CFR §260.2, unless this Permit specifically provides otherwise. Terms found in Module II shall have the meaning defined in 20 NMAC 4.1, Subpart I, §260.10, unless the Permit specifically provides otherwise. Where terms are not defined in the regulations or the Permit, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term. **"Secretary"** means the Secretary of the New Mexico Environment Department (NMED), a designee or authorized representative. **"Regional Administrator"** means the Regional Administrator of the U.S. Environmental Protection Agency (U.S. EPA), Region 6, or a designee authorized representative (the Secretary of the NMED). **"Permittee"** means the United States Department of the Air Force, Holloman Air Force Base (USAFHAFB), Otero County, New Mexico, EPA I.D. Number NM6572124422.

D.1 Facility

Whenever the word "facility" is used anywhere in the Permit text, such usage shall connote the entire complex comprising all contiguous land, and structures, other appurtenances, and improvements on the Permittee's land, as per 20 NMAC 4.1, Subpart I, 40 CFR §260.10.

D.2. Foreign Source

Whenever the words "foreign source" are used in the permit text, it is to be understood to mean hazardous waste generated outside the United States.

D.3. Off-site source

"Off-site source" refers to wastes generated outside the Permittee's facility.

D.4. On-site

Whenever the words "on-site" are used it is to be understood to mean on the same or geographically contiguous property as defined in 20 NMAC 4.1 Subpart I, 40 CFR §260.10.

D.5. Open Detonation

Whenever the words "open detonation" are used it should be understood to mean the disposal of explosives or munitions by propagating a detonation from a disposal charge to the explosives or explosive contained in the munitions under destruction.

D.6. Treatment Unit

Whenever the words "treatment unit" are used in the text, it should be understood to be the approximately 400 feet in diameter (122.0 meters) generally circular portion of the Permittee's facility (shown on the topographic map of figure G-3), where explosive ordnance disposal of waste munitions will be conducted.

E. DUTIES AND REQUIREMENTS

E.1. Duty to Comply

The Permittee shall comply with all conditions of this Permit, other applicable Federal, State, and Local Laws and Regulations, except to the extent and for the duration such noncompliance is authorized by an emergency Permit. Any Permit noncompliance, other than noncompliance authorized by an emergency Permit, constitutes a violation of RCRA and is grounds for enforcement action; for Permit termination, revocation and reissuance, or modification; or for denial of a Permit renewal application [20 NMAC 4.1, Subpart IX, §270.30(a)].

E.2. Duty to Reapply

If the Permittee wishes to continue an activity allowed by this Permit after the expiration date of this Permit, the Permittee shall submit a complete application for a new Permit at least 180 days prior to Permit expiration. [20 NMAC 4.1, Subpart IX, §§270.10(h), 270.30(b)].

E.3. Permit Expiration

Pursuant to 20 NMAC 4.1, Subpart IX, §270.50, this Permit shall be effective for a fixed term not to exceed ten years. As long as NMED is the Permit-issuing authority, this Permit and all conditions herein will remain in effect beyond the Permit's expiration date, if the Permittee has submitted a timely, complete application (see 20 NMAC 4.1, Subpart IX, §§270.10, 270.13 through 270.29) and, through no fault of the Permittee, the Secretary has not issued a new Permit (20 NMAC 4.1, Subpart IX, §270.51).

E.4. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for the Permittee, in an enforcement action that it would have been necessary, to halt or reduce the Permitted activity in order to maintain compliance with the conditions of this Permit [20 NMAC 4.1, Subpart IX, §270.30(c)].

E.5. Duty to Mitigate

In the event of noncompliance with this Permit, the Permittee shall take all reasonable steps to minimize releases to the environment and shall carry out such measures, as are reasonable, to prevent significant adverse impacts on human health or the environment. [20 NMAC 4.1, Subpart IX,§270.30(d)]

E.6. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain the OD treatment unit and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance/quality control procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit [20 NMAC 4.1, Subpart IX, §270.30(e)].

E.7. Duty to Provide Information

The Permittee shall furnish to the Secretary, within a reasonable time, any relevant information which the Secretary may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittee shall also furnish to the Secretary, upon request, copies of records required to be kept by this Permit [20 NMAC 4.1, Subpart V, §264.74(a), and Part IX, §270.30(h)].

E.8. Inspection and Entry

Pursuant to 20 NMAC 4.1, Subpart IX, §270.30(i), the Permittee shall allow the Secretary, or an authorized representative, upon the presentation of credentials and other documents, as may be required by law, inspection and entry privileges authorized by Permit Conditions from E.8.a. through E.8.d.

E.8.a. Enter at reasonable times upon the Permittee's premises where the regulated OD treatment unit or activity is located or conducted, or where records must be kept under the conditions of this Permit;

E.8.b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;

E.8.c. Inspect at reasonable times any unit, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit.

E.8.d. Sample or monitor, at reasonable times, for the purposes of assuring Permit compliance or as otherwise authorized by RCRA, any substances or parameters at any location. The Permittee shall be provided the opportunity to obtain split or duplicate samples.

E.9. Monitoring and Records

E.9.a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The method used to obtain a representative sample of the waste to be analyzed must be described in Permit Attachment A, the Waste Analysis Plan or be approved by the Secretary. Analytical methods must be those specified in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods SW-846, Standard Methods of Waste Analysis, or an equivalent method, as specified in Permit Attachment A or approved by the Secretary [20 NMAC 4.1, Subpart IX, §270.30(j)(1)].

E.9.b. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports and records required by this Permit, the certification required by 20 NMAC 4.1, Subpart IX, §264.73(b)(9), and records

of all data used to complete the application for this Permit for a period of at least 3 years from the date of the sample, measurement, report, record, certification, or application. These periods may be extended by request of the Secretary at any time and are automatically extended during the course of any unresolved enforcement action regarding this facility. [20 NMAC 4.1, Subpart IX, §270.30(j)(2)].

E.9.c. Pursuant to 20 NMAC 4.1, Subpart IX, §270.30(j)(3), records of monitoring information shall specify:

i. The dates, exact place, and times of sampling or measurements;

ii. The individuals who performed the sampling or measurements;

iii. The dates analyses were performed;

iv. The individuals who performed the analyses;

v. The analytical techniques or methods used; and

vi. The results of such analyses.

E.10. Reporting Planned Changes

The Permittee shall give notice to the Secretary, as soon as possible, of any planned physical alterations or additions to the Permitted OD treatment unit. [20 NMAC 4.1, Subpart IX, §270.30(l)(1)].

E.11. Reporting Anticipated Noncompliance

The Permittee shall give advance notice to the Secretary of any planned physical changes in the permitted OD treatment unit or activity which may result in noncompliance with permit requirements. [20 NMAC 4.1, Subpart IX, §270.30(l)(2)].

E.12. Certification of Construction or Modification

The Permittee may not commence treatment of hazardous waste at the OD treatment unit until the Permittee has submitted to the Secretary, by certified mail or hand delivery, a letter signed by the Permittee and a New Mexico registered professional engineer stating that the OD treatment unit has been constructed or modified in compliance with the Permit; and

E.12.a. The Secretary has inspected the modified or newly constructed OD treatment unit and finds it is in compliance with the conditions of the Permit; or

E.12.b. The Secretary has either waived the inspection or has not within 15 days notified the Permittee of his intent to inspect. [20 NMAC 4.1, Subpart IX, §270.30(1)(2)].

E.13. Transfer of Permits

This Permit is not transferable to any person, except after notice to the Secretary. The Secretary may require modification or revocation and reissuance of the Permit pursuant to 20 NMAC 4.1, Subpart IX, §270.40. Before transferring ownership or operation of the OD treatment unit during its operating life, the Permittee shall notify the new owner or operator in writing in accordance with the requirements of 20 NMAC 4.1, Subpart IX, §270.30(l)(3), and Part V, §264.12(c).

E.14. Twenty-Four Hour and Subsequent Reporting

E.14.a. The Permittee shall report to the Secretary any noncompliance which may endanger health or the environment. Any such information shall be reported orally within 24 hours from the time the Permittee becomes aware of the circumstances. The report shall include the following:

i. Information concerning release of any hazardous waste that may cause an endangerment to public drinking water supplies.

ii. Any information of a release or discharge of hazardous waste, or of a fire or accidental explosion at the hazardous waste management OD treatment unit which could threaten the environment or human health outside the hazardous waste management unit.

E.14.b. The description of the occurrence and its cause shall include:

i. Name, address, and telephone number of the owner or operator;

ii. Name, address, and telephone number of the facility;

iii. Date, time, and type of incident;

iv. Name and quantity of materials involved;

v. The extent of injuries, if any;

vi. An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and

vii. Estimated quantity and disposition of recovered material that resulted from the incident.

E.14.c. A written submission shall also be provided within five days of the time the Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period(s) of the occurrence including exact dates and times; and, if the

noncompliance has not been corrected; the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. The Secretary may waive the five-day written notice requirement in favor of a written report within 15 days. [20 NMAC 4.1, Subpart IX, §270.30(l)(6)].

E.14.d. If the Contingency Plan is implemented, the Permittee must comply with the reporting requirements listed in the Contingency Plan.

E.15. Other Noncompliance

The Permittee shall report all other instances of noncompliance not otherwise required to be reported above, Permit Conditions E.10. through E.15., at the time monitoring reports are submitted. The reports shall contain the information listed in Permit Condition E.14 [20 NMAC 4.1, Subpart IX, §270.30(l)(10)]

E.16. Other Information

Whenever the Permittee becomes aware that it failed to submit any relevant facts in the Permit application, or submitted incorrect information in a Permit application or in any report to the Secretary, the Permittee shall promptly submit such facts or information. [20 NMAC 4.1, Subpart IX, §270.30(l)(11)].

F. SIGNATORY REQUIREMENT

All applications, reports, or information submitted to or requested by the Secretary, a designee, or authorized representative, shall be signed and certified in accordance with 20 NMAC 4.1, Subpart IX, §270.11 and 270.30(k).

G. REPORTS, NOTIFICATIONS, AND SUBMISSIONS TO THE SECRETARY

All reports, notifications, or other submissions which are required by this Permit to be sent or given to the Secretary or

should be sent by certified mail or given to:

RCRA Permits Program Manager
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo
P.O. Box 26110
Santa Fe, New Mexico 87502

Telephone Number: (505) 827-1561

Facsimile Number: (505) 827-1544

H. CONFIDENTIAL INFORMATION

In accordance with 20 NMAC 4.1, Subpart IX, §270.12, the Permittee may claim confidential any information required to be submitted by this Permit. Confidential refers to industrial trade secrets and not National Security Confidential.

I. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

The Permittee shall maintain a written operating record of OD activities and laboratory results at the waste management directors office located at the Holloman Air Force Base OD Treatment Unit, in compliance with 20 NMAC 4.1, Subpart V, 264.73, until closure is completed and certified by an independent, New Mexico registered professional engineer, the following documents and all amendments, revisions and modifications to these documents:

1. Waste Analysis Plan, as required by 20 NMAC 4.1, Subpart V, §264.13 and this Permit.

2. Inspection schedules, as required by 20 NMAC 4.1, Subpart V, §264.15(b)(2) and this Permit.

3. Personnel training documents and records, as required by 20 NMAC 4.1, Subpart V, §264.16(d) and this Permit.

4. Contingency Plan, as required by 20 NMAC 4.1, Subpart V, §264.53(a) and this Permit.

5. Operating record, as required by 20 NMAC 4.1, Subpart V, §264.73 and this Permit.

6. Closure Plan, as required by 20 NMAC 4.1, Subpart V, §264.112(a) and this Permit.

7. Contingency Post-Closure Plan as per 20 NMAC 4.1, Subpart V, §264.310 and this Permit, in case the Permittee is unable to demonstrate clean closure.

8. Procedures for Limiting air Emissions, as required by 20 NMAC 4.1, Subpart V, §264.601(c); and Part IX, §270.23(c) and this Permit.

J. PERMIT CONSTRUCTION

J.1. Citations

Whenever paragraphs of this Permit or of the Hazardous Waste Management Regulations are cited, such citations include all subordinate sections of the cited paragraph. When subordinate sections are cited, such citations include all subsections of the cited paragraphs. All such citations shall be considered an inclusion by reference to this Permit in accordance with 20 NMAC 4.1, Subpart IX.

J.2. Gender

Whenever the pronoun "he" is used in reference to the Secretary of the New Mexico Environment Department or the Permittee, it is to be read as "she" in any instance where the person of the reference is female.

MODULE II - GENERAL FACILITY CONDITIONS

A. DESIGN AND OPERATION OF OPEN DETONATION TREATMENT UNIT

The Permittee shall construct, maintain, and operate the OD treatment unit to minimize the possibility of a fire, explosion, or any unplanned, sudden or nonsudden release of hazardous waste to air, soil, ground water or surface water which could threaten human health or the environment, as described in Permit Attachment G, in accordance with the requirements of 20 NMAC 4.1, Subpart V, §264.31.

B. REQUIRED NOTICES

B.1. Hazardous Waste Imports

This permit does not allow the Permittee to accept wastes from a foreign source. If the Permittee is to receive hazardous waste from a foreign source, he shall apply and receive a permit modification in accordance with 20 NMAC 4.1, Subpart IX, §270.41 or § 270.42 prior to accepting such waste.

B.2. Hazardous Waste from Off-Site Sources

"Off-site source" refers to wastes generated by sources other than the Permittee or its contractor(s) operating on-site. When the permittee is to receive hazardous waste from an off-site source, he must apply for permit modification in compliance with the requirements of 20 NMAC 4.1, Subpart IX, §270.41 or § 270.42 prior to accepting such waste.

C. GENERAL WASTE ANALYSIS

The Permittee shall follow the waste analysis procedures required by 20 NMAC 4.1, Subpart V, §264.13, as described in the Waste Analysis Plan, Permit Attachment A. In addition to the proposed soil sampling within and near the OD treatment unit (described in Permit Attachments A and J), the Permittee shall sample to a distance at least 100 feet in radius and to a depth of six (6) inches below ground surface, from the perimeter of the OD treatment unit during initial soil sampling. This sampling activity shall be coordinated with selection of the background samples proposed by the Permittee. This will assist in characterizing the OD treatment unit and its proximity. The

first soil sampling event shall be conducted within 180 days of the effective date of this permit.

The Permittee shall verify the analysis of each post-detonation soil sample following each quarterly open detonation event as part of its quality assurance program, in accordance with "The EPA Methods for Evaluating Solid waste: Physical/Chemical Methods, EPA Publication SW-846," or equivalent methods approved by the Secretary. At a minimum, the Permittee shall maintain proper functional instruments, use approved sampling and analytical methods, verify the validity of sampling and analytical procedures, and perform correct calculations. If the Permittee uses a contract laboratory to perform analyses, then the Permittee shall inform the laboratory in writing that it must operate under the waste analysis conditions set forth in this Permit.

D. SECURITY PLAN

The Permittee shall comply with the security provisions of 20 NMAC 4.1, Subpart V, §264.14(b) and §264.14(c) as described in Permit Attachment B.

Barriers and Means to control Entry

The Permittee shall maintain a barrier and a means to control entry in compliance with 20 NMAC 4.1, Subpart V, §264.14(b)(2).

A three-strand barbed-wire fence shall be built around the OD area to prevent unauthorized personnel and wild life from gaining access to the OD unit. Access to the open detonation unit shall be only through the current roadway barrier that is manned by armed security guards. This will serve to prevent access to the OD treatment unit by unauthorized personnel.

Warning Signs

Warning signs both in English and Spanish, for example: **DANGER, NO UNAUTHORIZED PERSONNEL, KEEP OUT", AND "*PELIGRO, NO PERMITIDA LA ENTRADA SIN AUTORIZACION,*"** shall be posted at the road entry point and where the perimeter approaches roads or active areas. The signs must be written in English and Spanish and must be legible from a distance of 25 feet (8 meters) and shall also be seen from any approach to the facility. In addition, the warning signs shall be posted at

300-foot (91-meter) intervals around the OD Range perimeter in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.14(c).

E. GENERAL INSPECTION REQUIREMENTS

The Permittee shall follow the inspection schedule set out in Permit Attachment C. The Permittee shall remedy any deterioration or malfunction discovered by an inspection, as required by 20 NMAC 4.1, Subpart V, §264.15(c). Records of inspection shall be kept, as required by 20 NMAC 4.1, Subpart V, §264.15(d).

F. PERSONNEL TRAINING

The Permittee shall conduct personnel training, as required by 20 NMAC 4.1, Subpart V, §264.16. This training program shall follow the attached outline, Permit Attachment D. The Permittee shall maintain training documents and records, as required by 20 NMAC 4.1, Subpart V, §264.16(d) and (e).

G. SPECIAL PROVISIONS FOR HANDLING IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTE

G.1. Handling of Reactive Waste

The Permittee shall comply with the requirements of 20 NMAC 4.1, Subpart V, §264.17(a). The Permittee shall also follow the procedures for handling ignitable, reactive, and incompatible wastes set forth in applicable parts of 20 NMAC 4.1, Subpart V §264, Subpart I, and the procedures specified in Permit Attachments H and I.

G.2. Container Management

The Permittee shall not place hazardous waste in unwashed containers that previously held incompatible waste or material in accordance with 20 NMAC 4.1, Subpart V §264.177(b).

G.3. Hazardous Waste Storage

The Permittee shall follow the procedures for assuring that pyrotechnics, explosives, and propellant materials subject to treatment at the OD unit are not stored for greater than 90 days after they have been declared hazardous waste, in compliance with 20 NMAC 4.1, Subpart III, §262.34, and the procedures specified in Permit Attachment A, Waste Analysis Plan.

H. PREPAREDNESS AND PREVENTION

H.1. Required Equipment

At a minimum, the Permittee shall maintain at the EOD Team Office the equipment set forth in the Contingency Plan, Permit Attachment E, as required by 20 NMAC 4.1, Subpart V, §264.32.

H.2. Testing and Maintenance of Equipment

The Permittee shall test and maintain the equipment specified in Permit Condition H.1, as necessary, to assure its proper operation in time of emergency, as required by §20 NMAC 4.1, Subpart V, 40 CFR 264.33.

H.3. Access to Communications or Alarm System

The Permittee shall maintain access to the communications or alarm system, as required by 20 NMAC 4.1, Subpart V, §264.34.

H.4. Time to Conduct Open Detonation

The Permittee shall conduct Open detonation activities only between the hours of 7:00 am and 5:00 pm. No OD operations shall be conducted at night.

H.5. Weather Conditions

The Permittee shall not carry out OD operations when the wind speed exceeds 15 miles per hour (24 kilometers per hour). In addition, No OD activities shall be permitted if an electrical storm is within 10 miles of the 20,000 pound OD treatment unit.

H.6. The Permittee shall not carry out Open Detonation activities on any day when a thunderstorm is imminent or is within ten (10) miles (16 km) of the OD Treatment Unit.

H.7. The Permittee shall not conduct Open Detonation activities during a snow storm.

H.8. The Permittee shall not conduct Open Detonation practices during a dust storm or sand storm.

H.9. The Permittee shall not conduct Open Detonation when there is a range fire.

H.10. Arrangements with Local Authorities

The Permittee shall maintain arrangements with state and local authorities, as required by 20 NMAC 4.1, Subpart V, 40 CFR §264.37. If state or local officials refuse to enter into preparedness and prevention arrangements with the Permittee, the Permittee must document this refusal in the operating record.

H.11. Hazardous Waste Inventory

The Permittee will maintain, in an accessible location, a current inventory showing type, location, and quantity of **all** hazardous waste in storage that will be subject to treatment within 90 days. NMED does have a need and right to know the type, location and quantity of **all** Explosive/Reactive Hazardous waste.

I. CONTINGENCY PLAN

I.1. Implementation of Plan

The Permittee shall immediately carry out the provisions of the Contingency Plan, Permit Attachment E, whenever there is an accidental fire, explosion, or release of hazardous waste or constituents which could threaten human health or the environment in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.51.

I.2. Copies of Plan

The Permittee shall maintain and distribute copies of the Contingency Plan in accordance with the requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.53.

I.3. Amendments to Plan

The Permittee shall review and immediately amend, if necessary, the Contingency Plan, as required by 20 NMAC 4.1, Subpart V, 40 CFR §264.54.

I.4. Emergency Coordinator

A trained emergency coordinator shall be available at all times in case of an emergency, in compliance with 20 NMAC 4.1, Subpart V, 40 CFR §264.55. He must implement the requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.56.

J. RECORDKEEPING AND REPORTING

In addition to the recordkeeping and reporting requirements specified elsewhere in this Permit, the Permittee shall do the following:

J.1. Operating Record

The Permittee shall maintain a written operating record of OD activities at the 20,000 pound open Detonation Treatment unit in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.73.

J.2. Biennial Report

The Permittee shall comply with the biennial reporting requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.75.

J.3. Personnel and Telephone Number Changes

The Permittee shall inform the NMED Secretary of changes in their management personnel, when a new officer replaces the current contact person. In addition, the Permittee shall keep the Secretary informed about any changes in its telephone numbers within 10 calendar days of the change in numbers. This updated information Permit Condition will not require a Class I Permit Modification.

K. GENERAL CLOSURE REQUIREMENTS

K.1. Performance Standard

The Permittee shall close the OD treatment unit as required by 20 NMAC 4.1, Subpart V, 40 CFR §264.111 and in accordance with the Closure Plan contained in Permit Attachment F.

K.2. Amendment to Closure Plan

The Permittee shall amend the Closure Plan, in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.112(c), whenever necessary.

K.3. Notification of Closure

The Permittee shall notify the Secretary in writing at least 60 days prior to the date on which he expects to begin closure of the OD treatment unit or final closure of the OD treatment unit, as required by 20 NMAC 4.1, Subpart V, 40 CFR §264.112(d).

K.4. Time Allowed For Closure

After receiving the final volume of hazardous waste, the Permittee shall treat, remove from the unit and dispose of at a permitted site all hazardous waste and shall complete closure activities, in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.113 and the schedules specified in the Closure Plan, Permit Attachment F or as amended by the requirement of Permit Condition L.2.

K.5. Disposal or Decontamination of Equipment, Structures, and Soils

The Permittee shall decontaminate or dispose of all contaminated equipment, structures, and soils, as required by 20 NMAC 4.1, Subpart V, §264.114 and the Closure Plan, Permit Attachment F.

K.6. Certification of Closure

The Permittee shall certify that the OD treatment unit has been closed in accordance with the specifications in the Closure Plan, as required by 20 NMAC 4.1, Subpart V, §264.115. The certification shall be signed by the Permittee and a New Mexico independently registered professional engineer.

L. GENERAL POST-CLOSURE REQUIREMENTS

L.1. Post-Closure Care Period

The Permittee shall begin post-closure care for the Open Detonation Treatment Unit after completion of closure, when NMED has determined that the Permittee could not achieve clean closure at the OD Treatment unit. Post-closure care of the unit shall continue for 30 years after that date, in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.117 and the Post-Closure Plan contained in Permit Attachment F.

L.2. Amendment to Post-Closure Plan

The Permittee shall amend the Post-Closure Plan in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.118(d), whenever necessary.

L.3. Post-Closure Notices

No later than 60 days after certification of closure of the OD unit, the Permittee shall submit records of the type, location, and quantity of hazardous waste disposed of within the OD unit, in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.119(a).

L.4. Post-Closure Permit Modification

The Permittee shall request and obtain a Permit modification prior to post-closure removal of hazardous wastes, hazardous waste residues, liners, or contaminated soils, in accordance with 20 NMAC 4.1, Subpart V, 40 CFR §264.119(c).

L.5. Certification of Completion of Post-Closure Care

The Permittee shall certify that the post-closure care period was performed in accordance with the specifications in the Post-Closure Plan, as required by 20 NMAC 4.1, Subpart V 40 CFR §264.120.

MODULE III

TREATMENT OF ENERGETIC WASTES

A. MODULE HIGHLIGHTS

This module contains a general description of the requirements for permitted and prohibited waste identification, the design plan of the Open Detonation Treatment Unit, and the standard operating procedures. Also included are the conditions for the amount of waste munitions that the Permittee will be allowed to be treat, how the wastes are to be handled prior to OD activities, the sampling and analysis plan for the potentially contaminated soil following OD operations, and the procedures for limiting air emissions. Further, the climatic conditions, risk assessment, and methods of protecting the environmental media are stipulated.

B. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

B.1. The Permittee may Open Detonate only the wastes listed in Permit Attachment N (i.e., EPA Part A Hazardous Waste Permit Application: Permitted Waste Codes and Maximum Treatment Quantities) and in Permit Attachment A, Waste Analysis Plan. The Permittee is prohibited from treating Radioactive Nuclear Waste, Mixed Waste, and Polychlorinated Biphenyls (**PCBs**). All treatment shall consist of explosive Open Detonation only.

B.2. The Permittee is prohibited from treating hazardous waste that is not identified in Permit Condition B.1. of this Module, including shipping and storage containers for waste explosives. The amount of waste munitions to be open detonated shall not exceed 450,000 pounds Net Explosive Weight (NEW) per calendar year or 4,500,000 pounds NEW for the permitted life of the OD Treatment Unit.

B.3. The Permittee shall not Detonate more than 20,000 pounds NEW of waste munitions per explosive event, except in case of an emergency, after receiving authorization from the Secretary, NMED.

C. OPEN DETONATION ON THE GROUND:

C.1. The Permittee shall maintain and operate the OD Treatment Unit to minimize the possibility of a fire, explosion, or any unplanned, sudden or nonsudden release of hazardous waste constituents to air, soil, or surface water which could threaten human health or the environment, as required by 20 NMAC 4.1, Subpart V, 40 CFR §264.31 and §264.601. The Permittee shall maintain the structures and equipment and follow the design plan described in Permit Attachment G.

C.2. The Permittee shall operate and maintain the Open Detonation pits in accordance with the standard operating procedures contained in Permit Attachment I, Standard Operating Procedures.

C.3. The Permittee shall operate and maintain the Open Detonation pit in order to minimize air emissions or exposure of people (on-site or off-site) to toxic or hazardous emissions as described in Permit Attachment M.

C.4. The Permittee shall operate and maintain the Open Detonation pit in order to minimize noise.

C.5. Residues from the Open Detonation pit shall be managed in accordance with Permit Attachment A.

C.6. The Permittee shall construct, operate and maintain run-on control systems in accordance with the design plans, specifications, and operating practices contained in Permit Attachments B, in compliance with the requirements of 20 NMAC 4.1 Subpart V, 40 CFR §264.601(a)(1)(3)(4); (b)(2)(3)(4) and (c)(4).

C.7. The Permittee shall construct, operate and maintain run-off control systems in accordance with the specifications, and operating practices which are described in Permit Attachment G.

C.8. The Permittee shall construct protective berms at least 2 feet high on the east and south sides of the OD unit to complement the natural berms that exist on the north and west sides of the pit. These berms shall be maintained in such a way that

surface drainage will be eliminated from entering the active portion of the OD pit created by open detonation activities, in accordance with [20 NMAC 4.1, Subpart V, 40 CFR §264.301(g)].

C.9. The Permittee shall not allow accumulated precipitation in any portion of the OD pit created by open detonation activities. All standing water shall be removed within 24 hours after a precipitation event. The water thus removed shall be treated as a hazardous waste, if sampling and analysis shows that it contains contaminant constituents beyond the regulatory thresholds.

C.10. Trilingual (English, Spanish and Apache) Warning signs shall be posted on all four sides of the Open Detonation Treatment Unit as specified in 20 NMAC 4.1, Subpart V, 40 CFR §264.14(c).

D. WASTE ANALYSIS PLAN

Pre-detonation chemical analysis may not be conducted on the explosive waste munitions due to the inherent hazardous nature of the reactive waste, as explained in Permit Attachment A, Waste Analysis Plan. The Permittee shall therefore characterize the waste munitions using generator supplied acceptable knowledge, published literature, including Material Safety Data Sheets (MSDSs), or equivalent technical information that contains all the chemical composition (and percentages) required to demonstrate that the Facility (HAFB) has acceptable knowledge to verify the inherent danger and "Energetic Potential" of each waste stream to be detonated.

The Permittee shall carry out the Waste Analysis Plan for post detonation soils as described in Permit Attachment A.

E. RISK ASSESSMENT

The Permittee shall generate Screening Action Levels for current Reference Dose (non-carcinogenic) and/or slope Factor (carcinogen) data listed (in order of preference) in Integrated Risk Information Systems (**IRIS**), Health Effects Assessment Summary Tables (**HEAST**), or other acceptable EPA sources. This risk assessment shall be done whenever contamination is determined below the soil surface, in excess of 0.01 confidence level. The Permittee must submit an ecological risk assessment to the HRMB for approval prior

to conducting its ecological risk assessment. NMED will decide on the cleanup level after reviewing the ecological risk assessment. Final Risk Assessment will be expressed as an aggregate Risk Assessment using EPA's Ecological Assessment of Hazardous Waste Sites (1989).

F. INSPECTION SCHEDULES AND PROCEDURES:

The Permittee shall inspect the OD Treatment Unit in accordance with the inspection schedule presented in Permit Attachment C. These inspections shall also include search for, and the collection of any unexploded ordnance (**UXO**), metal casings, and related "kickouts". The collected UXOs shall be redetonated immediately after the initial post-detonation operation. All UXO metal casings, other metal casings, and fragments shall be placed in appropriate containers, and handled as RCRA hazardous waste. Recovered lead fragments shall also be containerized and handled as hazardous waste.

G. SPECIAL PROVISIONS FOR HANDLING IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTE

The Permittee shall follow the special procedures for handling ignitable, reactive, and incompatible wastes set forth in Permit Attachment H in compliance with the requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.17(a).

H. STANDARD OPERATING PROCEDURES

H.1. The Permittee shall operate and maintain the OD Treatment Units in accordance with the operating procedures contained in Permit Attachment I.

H.2. The Permittee shall conduct OD activities only between the hours of 7:00 am and 5:00 pm from Monday through Sunday during any week, except in case of an emergency.

H.3. Under no circumstances shall OD operations be conducted after sunset, or between the hours of 5: pm and 7:00 am during any day or night of the week.

H.4. The Permittee must ensure that not less that two persons are present at the OD unit during any OD operations. No one shall be allowed to conduct OD activities alone.

H.5. The Permittee must carry out OD activities in compliance with the safety precautions contained in the

Standard Operating Procedures, Permit Attachment I.

I. SAMPLING AND ANALYSIS FOR AIR AND SOIL MONITORING

I.1. The Permittee shall evaluate the potential impact of the air pollutants on human health before, during, and after OD operations by screening and assessment in compliance with 20 NMAC 4.1, Subpart V, 40 CFR §264.601(c)(5), as per U.S. Army Environmental Hygiene Agency Publication and/or U.S. EPA approved models.

I.2. The permittee shall specify the types and schedules of air monitoring required and the instrumentation required, and should include a Sampling and Analysis Plan and present the findings to the NMED Secretary once a year. This shall be conducted when soil sampling indicates the potential of hazardous waste constituents to impact ground water.

I.3. The Permittee shall conduct soil sampling and analysis program in accordance with Permit Attachment J as required by 20 NMAC 4.1, Subpart V, §40 CFR 264.278 and §264.601(b)(1)(8)(11).

I.4. The Permittee shall carry out quarterly soil sampling within 72 hours after the last quarterly Open Detonation event. The soil sampling shall be preceded by an inspection of the OD Unit and removal of any unexploded ordnance by trained Ordnance Disposal personnel.

I.5. The Permittee shall implement a quarterly soil sampling and analysis program as described in Permit Attachment J of this permit text.

I.6. The Quality Assurance/Quality Control program to be implemented shall be as contained in Permit Attachment J, which is included herein.

J. CLIMATIC CHARACTERISTICS OF THE OD UNIT AND PROCEDURES FOR PROTECTION OF HUMAN HEALTH AND ENVIRONMENTAL MEDIA.

J.1. The Permittee shall not carry out Open Detonation operations when there is unauthorized personnel on the OD Treatment Unit.

J.2. The Permittee shall not conduct Open Detonation operations at any given time when wind speed exceeds 15

miles per hour (24 km/hour).

J.3. The Permittee shall not carry out Open Detonation activities on any day when a thunderstorm is imminent or is within ten (10) miles (16 km) of the OD Treatment Unit.

J.4. The Permittee shall not conduct Open Detonation activities during a snow storm.

J.5. The Permittee shall not conduct Open Detonation practices during a dust storm or sand storm.

J.6. The Permittee shall not conduct Open Detonation when there is a range fire.

K. RECORDKEEPING

The Permittee shall develop and maintain all records at the EOD Office at HAFB, in accordance with the requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.73, and §264.602, as contained in Permit Attachment L.

L. ASH MANAGEMENT PROCEDURES

L.1. The Permittee shall manage residues from the Open Detonation Treatment Unit as described in Permit Attachment J.

L.2. Within 72 hours after each treatment event, Ordnance Disposal personnel shall police the cleared area within the fence surrounding the OD Unit for fragments of waste (including metal casings) originating from treatment operations, and "kickouts". This shall be done only after it has been established that it is safe for personnel to reenter the active portion of the OD unit. If waste fragments, metal casings and kickouts are found, they shall be handled accordingly as described in Permit Attachment K.

M. GROUND WATER MONITORING

The Permittee shall conduct ground water monitoring using the Monitoring Wells (MW-01 through MW-04) shown on Figure G-5, Permit Attachment G, when soil sampling results indicate contamination, in accordance with 20 NMAC 4.1, 40 CFR Subpart V, §264 Subpart F.

N. AIR MODELING AND MONITORING

The Permittee shall use the air modeling presented in Permit Attachment M as a baseline for subsequent OD operations during the permitted life of the OD Unit. This is required because of the large amount of waste munitions that the Permittee plans to treat. Air monitoring is required despite the justification presented in Permit Attachment K, in order to be consistent with NMED's requirement that all facilities conducting open detonation activities must monitor the ambient air during each open detonation. This is in compliance with environmental protection requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.601(c).

PERMIT ATTACHMENTS

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PERMIT ATTACHMENT A

WASTE ANALYSIS PLAN

Introduction

The following information was provided in accordance with the requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.13. The following paragraphs contain a description of the physical and chemical characteristics of the waste that will be treated at the 20,000-pound (**lb**) Open Detonation (**OD**) unit.

The 20,000 lb OD unit consists of a cleared area within which waste explosives and propellant devices will be detonated. The wastes that will be treated are considered characteristically hazardous on the basis of reactivity (D003). During treatment, the waste to be treated is placed on top of the ground. Detonation charges that consist of cyclotrimethylene trinitramine (RDX) explosive are added to the pile in order to detonate the waste. The detonation reaction renders the explosive wastes nonreactive and results in both solid and gaseous by-products. Depending upon combustion conditions, the gaseous by-products will consist of carbon monoxide (CO), carbon dioxide (CO_2), water (H_2O), nitrogen (N_2), and various nitrogen oxides (NO_x). Solid by-products include casings from the waste and possibly trace concentrations of incompletely oxidized reactive material. Reaction by-products that are solid will be retained in the depression created by the explosive force (except for ejected components), but the gaseous reaction by-products vent to the atmosphere. These solid by-products will be gathered and re-detonated or drummed for proper disposal. Due to the difficulties and obvious hazards associated with collection of gas samples in the immediate vicinity of the detonation zone, this plan does not address the gas phase reaction by-products. An assessment of the gaseous constituents released during combustion is provided in Permit Attachment K.

CHEMICAL AND PHYSICAL ANALYSIS

Detailed chemical and physical analyses have been performed by the Department of Defense for all military ordnance material. These analyses have been compiled into ordnance material specifications and "Technical Supply Bulletins." Due to the vast amount of knowledge on the composition of ordnance materials that has been assembled for each particular ordnance material, and the dangers involved in deactivating a bomb or explosive, samples of the waste ordnance materials are not routinely obtained and chemically analyzed. Instead, a well-defined knowledge of the

constituents used in making the ordnance materials has been compiled. This understanding of the waste constituents is presented in lieu of extremely dangerous predetonation sampling and analysis. A chemical analysis would not yield additional information and could pose a risk to sampling and analysis personnel.

The wastes that are treated in the 20,000 lb OD Unit are generally propellant devices and explosives with expired shelf lives. Rocket motors exceeding 300 pounds are regularly treated at the 20,000lb OD Unit. Similar constituents are used in the formulation of the different items, but the quantity of specific energetic materials varies. In addition to the energetic material, the waste consists of the unit metallic components associated with these devices such as the casing. The total mass of the energetic material is typically limited to less than 10,000 pounds per device. The energetic materials contained in these wastes are considered characteristically hazardous on the basis of reactivity (D003). Nitroglycerin (P081) is listed on the basis of its reactivity. The reactive wastes are identified as such because these materials are explosives that deflagrate or detonate when subjected to shock or heat.

Single-base propellants contain nitrocellulose (with 12.5-13% N) as the primary constituent. In addition to nitrocellulose, single-base propellants contain organic nitrocompounds, stabilizers, and metal salts. The organic nitrocompounds commonly employed in single-base systems include trinitrotoluene and dinitrotoluene. Organic nitro compounds are utilized to disperse the nitrocellulose as colloidal particles. Stabilizers are required in the composition due to the tendency of nitrocellulose to decompose during storage, particularly as moisture is absorbed. Decomposition of nitrocellulose is an exothermic reaction that is indicated initially by an acid odor or condition that progresses to emission of red fumes and spontaneous ignition as the propellant becomes unstable. Due to this condition, nitrocellulose-based propellants are stored in bulk, are vigorously monitored for pH changes, and are compounded with stabilizers used to retard decay. Typical stabilizers used to retard this condition include diphenylamine, nitrodiphenylamine, diethyl diphenylurea, and petroleum jelly (cordite). As decomposition proceeds, nitrophenylamines, nitroureas, and nitroanilines are formed. This variety of the analogs will be present in waste single-based propellants. However, as the original concentration of the stabilizer seldom exceeds 1.0%, the concentration of those decomposition products will be in the parts per thousand range.

In addition to nitrocellulose fuel, nitro-based dispersion agent, and stabilizer certain propellants incorporate small quantities of metal compounds and elements. These compounds include potassium sulfate, tin and graphite that are not characteristically hazardous.

Double-base propellant formulations include both nitrocellulose and nitroglycerin with limited quantities of stabilizers and additives. Nitroglycerin serves as both the gelatinizing agent and a fuel in these compositions. In addition to the nitroglycerin, small quantities of dibutylphthalate, diethylphthalate, or triacetin are compounded to enhance colloidal suspension of the nitrocellulose. The stabilizing agents for double-base compositions do not differ from the stabilizers common to single-base systems. However, the metallic additives for double-base systems may include barium or potassium nitrate, calcium sulfate, calcium carbonate, or lead stearate in addition to the metallics used in single-base compositions.

The relative concentrations of these components in propellants varies depending upon the intended end use. In general, nitrocellulose is the predominant constituent and is present in concentrations of 50 to 70%. Nitroglycerin is the second largest constituent in the propellant composition. These two compounds constitute greater than 95% of the standard military double-base formulations. The addition of inerts and stabilizers provides the balance to greater than 99% of the formulation, with less than 1.0% of the formulation composed of various nitrates or lead stearate.

Composite propellants consist of ammonium nitrate , an inorganic oxidant such as potassium nitrate, and an organic binder. These propellants are heterogeneous solids that may be press formed to the desired shape. Composite formulations are not handled at the 20,000 lb OD Unit.

Although the term "colloidal suspension" has been applied to propellants, these compositions are completely solid without free liquids. Physically, propellant compositions consist of powders that are incorporated into solid or waxlike binders and pressed into strips, cords, and other linear shapes. Although dry nitrocellulose is unstable, incorporation of the binders renders the mixture relatively stable. Propellants, including double-base formulations, are not sensitive to shock and cannot be ignited by ordinary shock or frictional effects. Propellants are sensitive to electric spark only if the material has been finely divided and is present as dust. Thus, propellants present a fire hazard to the degree that a sufficiently strong heat source is

available to ignite the composition. Unless finely divided, ignition usually requires either open flame or detonation of a high explosive placed adjacent to the propellant material.

The composition of commonly utilized single-base and double-base propellants is provided in Table A-1. Specific propellants that have been, and will be thermally treated at the 20,000 lb OD Unit are discussed in a future section.

Table A-1

Standard Compositions (%) for Single- or Double-Base Propellants

	M-1 (a) Single Base	M-3 Single Base	M-14 Single Base	Double-Base Common	Double Base Calibers 20, 30, 50	Double Base Mortar Propellant	Double Base Rocket Propellant M-Series	Double Base Rocket Propellant T-Series (a)
Nitrocellulose	84.2	79	89.1	77 - 81	74 - 84	52 - 57	55 - 58	58
Nitroglycerin				15 - 19	15 - 20	40 - 43	30 - 40	22 - 40
Barium/Potassium Nitrate				2.1	0.0 - 1.5	1.25 - 1.5		
Potassium Perchlorate							0.0 - 7.8	
Graphite				0.3	0.0 - 0.25			
Dinitrotoluene	9.9	15	7.9					0.0 - 2.5
Trinitrotoluene								
Diphenylamine					0.75	0.75	1.0 - 8.0	1.75 - 8.0
Diethylphenylamine				0.6		0.0 - 0.6		
Potassium Sulfate							0.0 - 1.5	0.0 - 1.5
Tracetin		5	2.0					
Dibutylphthalate	4.9		1.0			3.0		
Cryolite	1.0	1.0						

Nitroglycerin has been discussed previously in conjunction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately 13°C. The specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at 20°C. Nitroglycerin decomposes with gas evolution at temperatures of 145°C. The published explosion temperature for nitroglycerin is 222°C, with evolution of approximately 368 Kcal/mol of heat and 715 mL of gas per gram of charge. Nitroglycerin is extremely sensitive to shock, being detonated by a 2 kg weight dropped from a height of 16 cm in the Bureau of Mines reactivity tests. For this reason, nitroglycerin is compounded with other energetics or inerts to facilitate handling. In pure form, it may be absorbed through the skin into the circulatory system and causes increased pulse rate and blood pressure.

Nitrocellulose is a mixture of esters formed by the nitration of cellulose with a mixture of sulfuric and nitric acids. As used in military formulations, nitrocellulose contains a minimum of 12.2% nitrogen. Although nitrocellulose is not truly soluble in any solvent, certain alcohols, ketones, and aromatic nitrocompounds will disperse nitrocellulose as a colloidal suspension. Water has no solvent action upon nitrocellulose but is absorbed to between 2-3% with the resultant deterioration to the unstable form. Cellulose nitrate has a specific gravity` of 1.65. The explosive temperature for cellulose nitrate is approximately 230°C with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal/mol of heat upon detonation that is accompanied by evolution of approximately 700 mL of gas per gram charge. Nitrocellulose is extremely sensitive to spark ignition if handled in dry form. The shock sensitivity of nitrocellulose is greater than that of nitroglycerin and is listed as detonation by a 2 kg weight dropped from a height of 9 cm in the Bureau of Mines test.

WASTE IN CONTAINERS

All waste that will be treated at the 20,000 lb OD Unit will be transported to the treatment area in the original product container or other appropriate packaging. Propellants are contained within chambers that are generally cylindrical in shape and constructed of aluminum and steel. A primary consideration in the development of propellant, explosive, or pyrotechnic systems is long-term storage stability which requires compatibility of container and the energetic material.

Receipt of the waste in the product container, combined with the fact that commonly-used military propellants are compatible with one another, ensures the fact incompatible wastes are not mixed. The reactive wastes to be treated at the 20,000 lb OD Unit are solid in nature and contain no free liquid.

CHARATERISTICS OF WASTE TO BE TREATED AT THE OD UNIT

This section also addresses the characteristics of the waste that must be known for proper management of the waste. This information is derived from published sources. Analysis to support the published data is not required because of the limited deviation allowed within the product specifications that manufacturers of military propellants must follow. The waste that is treated at the 20,000 lb OD Unit has essentially the same composition as serviceable propellants, but is being disposed of because of shelf-life exceedance, deterioration during storage, or failure to complete exhaust during testing of motors.

In general, the characteristics of the waste that must be known are:

- Presence of free liquids,
  Basis for hazard designation,
- Waste composition,
- Ignition or explosion temperature,
- Heat of combustion and/or detonation,
- Sensitivity to shock or electrical ignition,
- Storage stability (tendency to decompose during storage),
- Compatibility with container or other energetic material, and
- Solubility characteristics.

It must be noted that the unique nature of these materials presents difficulties in development of these data in all instances. In some instances, the parameters are not readily measured because of the instability of the material. For many energetic materials, the particle size, degree of subdivision, compressed density of the material in the ordnance, age, and atmospheric conditions affect the value derived for these parameters. The same material may provide different values for certain parameters for no apparent reason. Thus, the published data presented in this section represents the accepted values for those parameters derived from various tests.

Table A-2 identifies all explosive compounds and other substances that will be used or treated at the OD Unit. As shown in Tables A-1 and A-2, there are several explosive materials that are used in a variety of combinations to manufacture explosives and propellant devices. All of these explosives are solid materials that do not contain liquids. The main explosive materials and a description of each are as follows:

Black Powder

Black powder is the oldest known explosive material. It is a composite material made from saltpeter (potassium nitrate), charcoal, and sulfur. It is a lower powered explosive and is commonly used in time fuses, igniters, and detonators.

Table A-2
Explosive Compounds Used or Treated at the OD Unit

Name	Chemical Formula	Use
AMATOL	(ammonia nitrate/TNT)	main charge, armor piercing projectiles
AMMONAL	(ammo nitrate/TNT/Al)	main charge, semi-armor piercing bombs
AMMONIUM NITRATE	NH_4NO_3	main charge, cratering chg
BALLISTITE	(nitrocellulose/nitroglycerin/ diphenylamine/graphite)	propellant, rocket motors
BARATOL	(TNT/BARIUM NITRATE)	main charge
BLACK POWDER	(potassium nitrate/charcoal/sulfur)	propellant, mixtures
COMP A	(RDX/wax)	boosters, fuzes
COMP B	(RDX/TNT/wax)	main chg, projectiles, bombs, warheads
COMP C-4	(RDX/oil/polyisobutylene/ diethylhexylsebacate)	demotion charge
CYCLOTRIMETHYLENE TRINITRAMINE (RDX)	$C_3H_6N_6O_6$	mixture, detonators, demo charges
DBX	(ammo nitrate/RDX/Al)	main charge, depth bombs
DIAZODINITROPHENOL (DDNP) (DINOL)	$HOC_6H_3(NO_2)_2N$	blasting caps, detonators
DOUBLE BASE SMOKELESS POWDER	(guncotton/nitroglycerin)	propellant
EXPLOSIVE D (AMMONIUM PICRATE)	$NH_4C_6H_2N_3O_7$	bursting chg, armor piercing projectiles
GUNCOTTON	(nitrocellulose)	propellant
HEXANITE #26	(TNT/HND/Al)	main charges

Table A-2 (Continued)

Name	Chemical Formula	Use
HEXITE (HEXANITRO-DIPHENYLAMINE)	$C_{12}H_5N_7O_{12}$	mixtures
HMX	$C_4 H_8N_8O_8$	mixtures, boosters
H-6	(RDX/TNT/Al/CaCl)	main charges, naval bombs, depth charges
HTPB (HYDROXY-TERMINATED POLYBUTADIENE)	HO-(C H) -OH	solid fuel propellant
LDNR	$PbC_6H_2N_2O_6$	blasting caps
LEAD STYPHNATE	$C_6H(NO_2)_3(O_2Pb)$	initiators, primers, detonators
MANNITOL HEXANITRATE	$C_6H_8(NO_3)_6$	initiators, blasting caps
MERCURY FULMINATE	$HgC_2N_2O_2$	initiators, blasting caps
MINOL	(TNT/ammo nitrate/Al)	main charges, bombs, projos
NITROGLYCERIN	$C_3H_5(ONO_2)_3$	propellant compositions
PENTOLITE	(TNT/PETN)	bursting chgs
PETN	$C(CH_2ONO_2)_4$	mixtures, boosters, detonating cord
PICRATOL	(Explosive D/TNT)	main charges
PICRIC ACID #26	$C_6H_2(NO_2)_3OH$	boosters, bombs
PICRITE	$CH_4N_4O_2$	propellant
TETRYL	$(NO_2)_3C_6H_2N(NO_2)CH_3$	mixtures, boosters
TNPH	$C_6H_2(NO_2)_3C_2H_5$	mixtures, boosters, (sub for TNT)

Table A-2 (Continued)

Name	Chemical Formula	Use
TORPEX	(RDX/TNT/Al)	main charges, mines, torpedoes
TNT	$C_6H_2CH_3(NO_2)_3$	main charges, demo chgs, boosters, mixtures
TRITONAL	(TNT/Al)	main charges, bombs
TYPE 88 #26	(ammonium perchlorate/ferro-silicon/wood meal/crude petroleum)	main charges
TYPE 91 #26	$C_6H_2OCH_3(NO)_3$	main charges
TYPE 92 #26	(TNT/Al)	burster for Japanese bullets
TYPE 98	(trinitroanisol/hexanitro-diphenylamine)	primer, burster charge
TNA	$C_6H_3N_5O_8$	boosters
OCTOL	(HMX/TNT)	main charge, shape charges
METHYL PICRATE	$C_6H_2OCN_3(NO_2)_3$	main charge, bombs
POTASSIUM PERCHLORATE	$KClO_4$	pyrotechnic, fireworks
PHOTO FLASH POWDER	(barium nitrate/potassium perchlorate/Al)	ground burst simulators, photo bombs and projos
THERMITE	Fe_2O_32Al	grenades, document destroyers
THERMATE	Fe_2O_3 Al + Ba nitrate	document destroyers
HC SMOKE	ZnO_2C_6Cl Al	screening smoke
TITANIUM TETRACHLORIDE	$TiCl_4$	spotting chgs
WHITE PHOSPHORUS	P_4	screening/marking smoke
PLASTICIZED WHITE PHOSPHORUS	P_4 + synthetic rubber	marking smoke

- **Ammonium Nitrate:**

  Ammonium nitrate is the least sensitive of military explosives and must be initiated by a booster charge to ensure successful detonation. Ammonium nitrate is commonly used in composite explosives where it is combined with a more sensitive explosive. Ammonium nitrate is highly hygroscopic (readily absorbs moisture) and must be kept in a waterproof container.

- **Amatol:**

  Amatol is a mixture of ammonium nitrate and TNT that is commonly used as a substitute for TNT in bursting charges. The most common mixture of amatol is 80/20 (80% ammonium nitrate and 20% TNT). Because of its ammonium nitrate content, Amatol is highly hygroscopic and must be kept in a waterproof container.

- **Military Dynamite**:

  Military dynamite is a composite explosive that contains 75% cyclotrimethylene trinitramine (RDX), 15% TNT, and 10% desensitizers and plasticizers. Military dynamite is considerably more stable than commercial dynamites due to the absence of nitroglycerin.

- **Trinitrotoluene (TNT)**

  TNT is the most commonly used military explosive. It is used alone or in conjunction with other explosives for composite explosives. TNT is commonly used for boosters, bursting charges, or demolition charges.

- **Tetryl**

  Tetryl is commonly used alone as a booster charge. It can also be used as a bursting or demolition charge and, at times, can be used in composite charges. Tetryl is more powerful and more sensitive than TNT. Tetryl explosives are being replaced with RDX and PETN explosives due to the increased power and shattering effects of these two latter explosives.

- **Pentolite**:

  Pentolite is a mixture of PETN and TNT. The most common mixture of pentolite is 50% PETN and 50% TNT. This explosive is very powerful, has a high detonation rate, and is used in certain shaped charges.

- **Nitroglycerin**:

  Nitroglycerin is a highly powerful explosive and is comparable to RDX and PETN. It is commonly used as the base material for commercial dynamites. Nitroglycerin is highly sensitive and is affected by extreme temperatures. Due to its sensitivity, nitroglycerin is not typically used as a military explosive.

- **Composition B**:

  Composition B is a composite explosive containing 60% RDX, 39% TNT, and 1% wax. Because of the high RDX content, Composition B is more sensitive than TNT and is primarily used as the main charge in shaped charges.

- **Composition C4**:

  Composition C4 is a composite explosive containing 91% RDX and 9% nonexplosive plasticizers. Composition C4 is very stable over a wide range of temperatures and is only slightly water soluble. This explosive is used mainly as a bursting charge.

- **Composition C3**:

  Composition C3 is a composite explosive containing 91% RDX and 9% wax. The wax coats the RDX particles and acts as a desensitizer as well as a binder material. Composition C3 is used as a booster charge in newer charges and torpedoes as well as in high explosive plastic projectiles.

- **Pentaerythrite Tetranitrate (PETN)**:

  PETN is very sensitive and is one of the most powerful military explosives. PETN is used in boosters, detonating cords, blasting caps, and in composite explosives. PETN is not water soluble.

- **Cyclotrimethylene trinitramine (RDX)**

  RDX is very sensitive and, like PETN, is one of the most powerful of military explosives. It is often used alone as the base charge in M6 (electric) and M7 (non-electric) blasting caps. RDX can also be desensitized and used for sub-boosters, boosters, bursting charges, and demolition charges. RDX is commonly used in the manufacture of Composition A, B, and C explosives.

- **Composition B 4:**

  Composition B4 is a composite explosive that is very similar to Composition B with 60% RDX, 39.5% TNT, and 0.5% calcium sulfate. This explosive is used in newer shaped charges and bangalore torpedoes.

The composition of specific propellant devices that have been treated at the 20,000 lb OD Unit, and that are expected to require continued treatment, is provided in Table A-3. Additives to the double-base propellant compositions are also identified in Table A-3. Single-base or composite propellants are not thermally treated at the 20,000 lb OD Unit. In addition to the specific formulations for the propellants, Table A-3 identifies the components present in primer compositions or the initial detonating agents associated with these energetic items. The primer is not always treated in conjunction with the propellant. Table A-4 presents data on the characteristics of the constituent used in these propellants. Data on the explosive train (that is a serviceable ordnance, and not waste) is also presented in these tables.

Table A-3

Composition of Specific Propellants Thermally Treated at the OD Unit (also included is the RDX detonator)

Component	Constituent*	Mass or Concentration Weight %	Hazardous Waste Number
Rocket motor (5.0")*	Nitrocellulose Nitroglycerin Diphenylamine Potassium Sulfate	11.8 kg 8.2 kg 0.6 kg 0.3 kg	D003 D003, P081
Rocket motor (2.75")*	Nitrocellulose Nitroglycerin Diphenylamine Potassium Sulfate	2.0 kg 1.5 kg 0.3 50 grams	D003 D003, P081
Propellant detonator (not always present	Barium or Potassium Nitrate Lead Styphnate or DDNP Carbon Calcium Silicide	0.45 - 0.60 grams 0.20 - 0.40 grams 0.01 - 0.10 grams 0.10 grams	D001, D005 D003, D008
C-4 Detonating Charge (a,b) (size varies)	RDX Wax (polyisobutylenetethlhexyl-sebacate)		
Initial detonator cap (a) (for C-4 charge used in detonation)	Lead Styphnate Lead Azide Trinitrophenylmethylnitramine Mercury Fulminate Diazodinitrophenol (DDNP) Tetracene	0.55 - 2.5 grams 0.05 - 0.26 grams 0.1 - 0.2 grams 0.18 - 0.24 grams 0.12 - 0.28 grams 0.18 - 0.24 grams	D003, D008 D003, D008 D003 D003, D009 D003 D003, App. VIII
Explosive priming cap (b) (for C-4 charge used in detonation)	Potassium Chloride Antimony Sulfide or Lead Thiocyanate Lead Azide, PETN, or DDNP	0.05 - 0.05 grams	

(a) - Primer components (oxidant/fuel) are indicated in C-5.
(b) - Inerts include diphenylamine, potassium sulfate and wax, and were not considered.
* - May contain up to 2.5% Dinitrotoluene (U105, U106), but does not meet listing criteria and is present only as an appendix VIII hazardous constituent.
NOTE: The C-4 charge and its primary charges used for detonation are not wastes but are serviceable ordinance used to initiate the reaction.

Table A-4

Characteristics of Constituents in Propellants or Explosives Thermally Treated at the OD Unit

	Explosion Temperature (°C)	Heat of Detonation (Kcal/mol)	Heat of Combustion (Kcal/mol)	Gas Volume on Detonating	Impact Sensitivity (cm)	Spark Sensitivity	Storage Stability	Solubility (mg/L)
Nitrocellulose	230	272	661	700	9	High	Hydrolysis	Insoluble Hygroscopic (3%)
Nitroglycerin	222	337	368	715	16	Moderate	Stable	1600
RDX	260	285	507	908	32	Moderate	Stable	50
PETN	215	439	600	790	17	Sensitive	Stable	Unknown
Lead Azide	340	106	183	308	10	Sensitive	Stable	500
Lead Styphnate	282	213	585	368	17	Sensitive	Stable	1000
Tetryl	257	324	839	760	26	Sensitive	Stable	75
Mercury Fulminate	210	122	267	243	5	Sensitive	Stable	700
DDNP	195	172	681	865	10	Sensitive	Stable	Insoluble
Barium Nitrate	NA	NA	NA	NA	NA	NA	Stable	8.7×10^4
Potassium Nitrate	NA	NA	NA	NA	NA	NA	Stable	1.3×10^5
Potassium Chlorate	NA	NA	NA	NA	NA	NA	Stable	7.1×10^4
Antimony Sulfide	NA	NA	NA	NA	NA	NA	Stable	1.7
Lead Thiocyanate	NA	NA	NA	NA	NA	NA	Stable	500

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Three waste characteristics relevant to proper handling and treatment are not addressed in these tables: (1) the presence of free liquids, (2) compatibility of these wastes with the container, and (3) compatibility with other energetic materials. As previously indicated, the energetic compositions used for these military applications contain no free liquid and consist of finely divided powders or wax-like materials compressed to a variety of shapes. These wastes are managed in the original product container and the materials of the casing were specifically selected at the time of design to be compatible with the energetic material to ensure longevity during storage. Thus, further consideration of these compatibility concerns is not warranted and is prohibitive because of the dangers inherent in any attempt to re-package these materials. Furthermore, these wastes are not re-packaged or stored at the unit. The energetic formulations that are thermally treated at the 20,000-Pound OD Unit are mutually compatible as demonstrated by the fact that these materials are often blended together in a single formulation or conjointly packaged in a single device. In addition to their mutual compatibility, the energetic materials are not removed for blending purposes and, therefore, mixing of incompatible wastes does not occur. Although some limited data concerning reactivity toward water and other reagents are provided in this section, the wastes treated at the 20,000-Pound OD Unit are not mixed with any reagents incidentally or to effect treatment. Such data are provided solely for informational purposes.

The shock sensitivity of energetic materials may be determined by the Bureau of Mines impact test. The shock sensitivity data provided in this section are based on the Bureau of Mines method.

In practice, this method involves placement of 0.02 gram of the subject material in a brass cup that is subsequently impacted by a 2kg weight dropped from a measured height. Sensitivity is recorded as the height required to initiate detonation in one of ten tests.

Sensitivity to friction is measured by the pendulum test. In this method, a specifically weighted bare-metal shoe is attached to a pendulum designed to pass in contact with a grated anvil containing 7.0 grams of energetic materials 18 times during the test. This sensitivity test is utilized less often than impact and is, therefore, not reported.

Heat and electrical spark sensitivity are determined by several techniques. The most reliably reported data are the explosion temperature as determined by submersion of the subject material in a vat of heated bismuth alloy. Both the explosion temperature and any separately noted spark sensitivity data from energetic materials are reported in this section.

WASTE ANALYSIS PLAN

This section addresses the parameters of concern for waste that will be treated at the 20,000 OD Unit. The rationale for the selection of these parameters, sampling methods, analytical protocols, and frequency of analysis are described. Parameters and rationale for characterization of waste are discussed below in sections which cover predetonation and postdetonation respectively.

Holloman AFB has never been used for the research and development of nuclear, chemical welfare, or other exotic warfare types of weapons. The OD Unit is used solely for the disposal/treatment of conventional waste-ordnance, munitions, incendiaries, propellants, and rocket motors. The only munitions delivered or disposed of at Holloman AFB have been conventional live and training munitions. Therefore, the chemical components and combustion by-products are consistent with what is typical for military munitions items; thus, the emphasis of sampling and analysis for the OD Unit will be to search only for the constituents present in these types of wastes.

The nature of the treatment by-products is dependent upon the category of device from which the waste is derived. Propellant constituents will be converted largely to the gaseous products CO_2, CO, H_2O, N_2, and, to some degree, NOx. Some extremely limited possibility exists that these materials may fail to entirely decompose.

The nitrate oxidant from primers or detonators will convert to sodium or potassium nitrite ($NaNO_2$, KNO_2). Other oxidants are converted to the oxide. Fuels such as antimony sulfide or thiocyanate are converted to the oxide or sulfate.

The sampling and analysis plan outlined in Permit Attachment J focuses on solid reaction products because of the hazards associated with plume sampling in the vicinity of the treatment zone.

PARAMETERS AND RATIONALE (PREDETONATION)

Waste analysis will not be performed prior to the treatment of these wastes. Sampling prior to treatment would so greatly increase the potential for accidental detonation, with resultant property damage and personal injury, that such efforts are not warranted. The containers that hold these energetic materials (product or waste) are sealed in accordance with exceedingly specific manufacturing specifications designed to prolong storage stability and reduce the potential for unplanned detonation or ignition from impact. For example, nitrocellulose propellant mixtures are hygroscopic to 3-4 weight percent if exposed to moist air. The hydrolysis that accompanies exposure of nitrocellulose to air (even at low relative humidity values) renders the material unstable and evolution of NO_2 or auto-combustion occur. Dismantling of the devices (that would be required for sampling) not only increases hazard by exposure of material but increases the potential for detonation due to the friction and shock sensitivity of the materials.

Additionally, the composition of these materials is well defined on the basis of published literature and tightly controlled manufacturing specifications. Thus these materials are analogous to pure discarded commercial products for which sampling would only prove redundant. Prior to treatment of any waste not specifically identified in earlier pages, a complete listing of all ingredients common to that energetic item will be obtained to determine its suitability for treatment in the 20,000 lb OD Unit.

The use and handling of these materials is tightly controlled and the device is sealed; therefore, the possibility of mixing

unspecified items with the energetic materials does not exist. No other wastes are treated in conjunction with these devices in the 20,000 lb OD Unit because joint treatment is specifically prohibited by Technical Orders.

PARAMETERS AND RATIONALE (POSTDETONATION)

Post treatment analysis of residuals presents less risk to sampling and analytical personnel than attempts to perform predetonation sampling because successful treatment renders the waste non-reactive. Thermal treatment of propellants converts the alkoxynitrates to gaseous products. However, because it is technically impractical to sample evolved gas sampling in the treatment zone, the focus of this plan is the solid residuals that may remain in the pit.

Permit Attachment J contains a detailed Sampling and Analysis Plan (**SAP**) that covers all aspects of post-detonation waste sampling at the OD Unit. Specific topics covered in the SAP include: sampling approach and rationale, sampling procedures and methodology, health and safety procedures, sample handling and chain of custody (COC), sample documentation, laboratory procedures, quality assurance/quality control (QA/QC), and data evaluation methods.

Summary of Analytical Methods and Sampling Frequency:

Samples of the solid residuals and underlying soils will be prepared and analyzed according to protocols from *the EPA Publication: SW-846, Test Methods for Evaluating Solid Waste*, Third Edition. Samples will be analyzed for all toxic metals,

including priority pollutant metals (listed in the New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V, 40 CFR §264 Appendix IX), explosive residues, and soil moisture. Permit Attachment J, Sampling and Analysis Plan contains the specific test methods and lists of analytes that will be measured, as well as the rationale for their selection. In addition, details of laboratory protocols and quality assurance/quality control procedures are also discussed under the Sampling and Analysis Plan.

Samples of the treatment residuals and underlying soils will be taken quarterly to demonstrate the effectiveness of the treatment and to ensure that hazardous wastes are not present. This frequency was selected to ensure effectiveness of treatment and prevent storage of hazardous waste in the area. A stratified random sampling methodology will be used to collect representative samples as explained in detail in the sampling methodology.

PERMIT ATTACHMENT B

SECURITY PLAN

Introduction

The security procedures outlined in this section have been provided by Holloman Air Force Base in compliance with New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V, 40 CFR §264.601 and the general requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.33 and 40 CFR §264.15.

The following section addresses security procedures, inspection requirements, preparedness requirements, procedures taken to prevent accidental detonation, prevention of the mixing of incompatible waste, and means to reduce personnel exposure.

24-HOUR SURVEILLANCE SYSTEM

The primary mission of Holloman AFB is to provide upgrade and continuation training for aircrews assigned to T38, F-4, and F-117A aircraft. Additionally, solid base propulsion systems for military devices are tested at the area identified as the Test Track. The general nature of these activities is such that portions of the base facility are under constant surveillance. In particular, such areas include the Test Track Facility, flight line areas, and the munitions building. In addition to these surveillance measures, the main base area and any base area adjacent to these secure zones is patrolled at intervals both day and night.

Traffic access to Holloman AFB is possible from three routes. These include Highway 70 at the southern boundary of the base; the La Luz gate between Alamogordo and Tularosa; and, through White Sands Missile Range. The two gates are manned by armed guards 24 hours per day. White Sands Missile Range is also under continuous surveillance. These general surveillance practices provide 24-hour surveillance of the OD treatment unit. Additionally, during explosive open detonation events, constant surveillance of the OD treatment unit is provided by Test Track personnel and the Security Police.

BARRIER AND MEANS TO CONTROL ENTRY

The 20,000 lb OD Unit is located at the end of a single access road which runs approximately 20 miles along the length of the test track. Entrance to the test track area is strictly

controlled by Test Track personnel and the Security Police. Entrance to these units is restricted to authorized visitors on approval of the EOD supervisor. Visitors to the unit must be accompanied by EOD personnel. No visitors are allowed during detonation events. Additionally, the treatment unit is provided with only a single entrance. During detonation events, the area is routinely patrolled to prevent access to the OD unit.

The OD Treatment Unit is a restricted-access area, with the entire area boundary fenced and posted with warning signs at 400 feet intervals.

Warning Signs

HAFB will post warning signs within 100 feet (30.5m) of the perimeter of the OD Treatment Unit. These must be printed in both **English**, ***Spanish and Apache*** to read as follows (for example, English and Spanish): **"DANGER, NO UNAUTHORIZED PERSONNEL, KEEP OUT", AND "*PELIGRO, NO PERMITIDA LA ENTRADA SIN AUTORIZACION.*"** These signs will be posted at the road entry point and where the perimeter fence approaches roads or active areas. The gate will be marked with a sign which reads, "**Danger, Explosives**" and situated so as to prevent unauthorized access to the active portion of the OD treatment unit. Monthly security inspections will be conducted and recorded by the HAFB Security Police.

INTERNAL COMMUNICATIONS

Personnel that enter the treatment zone for inspection of operation are provided with hand-held two-way radios. Radio contact with Track Control is maintained at all times while in the restricted area.

EXTERNAL COMMUNICATIONS

External communications capabilities are provided through the base operator. Communications systems include Defense Switched Network (**DSN**), BTS, and the US West System.

EMERGENCY EQUIPMENT

Emergency equipment available at the OD treatment unit during operations include fire extinguishers, two-way radios, and personnel protective equipment such as gloves and respirators.

WATER FOR FIRE CONTROL

Water for fire control is not available at this unit. Base fire department trucks are available during operations for emergency response.

UNLOADING OPERATIONS

Procedures to prevent incidental detonation of the waste are also applicable to spill prevention during pretreatment operations. EOD procedures to prevent accidental detonation are detailed in Air Force Publications TO 11A-1-42 and TO 11A-1-60. In general, these procedures specify the use of nonsparking tools, encasement to reduce impact, use of certain clothing materials, and, most importantly, removal of primers and initial detonators from the device. The explosive nature of the waste indicates the greater hazard to be incidental detonation during transfer of waste into the detonation zone. None of the energetic waste contains free liquid.

PERMIT ATTACHMENT D

PERSONNEL TRAINING

Introduction

The following information has been provided in accordance with the requirements of 20 NMAC 4.1, Subpart V, 40 CFR §264.16.

Training Outline

Facility personnel who handle hazardous wastes must successfully complete a program of classroom instruction and on-the-job-training in order to prepare them to operate and maintain the facility/unit in a manner which ensures that facility's compliance with RCRA training requirements.

All HAFB EOD personnel attend the Explosive Ordnance School at Indian Head Naval Ordnance Station, Indian Head, MD. Explosive Ordnance School incorporates hazardous waste management training for the specific wastes that are treated in the unit. This is the single training point for all military personnel in the EOD career field. Senior EOD personnel also support this training with on-the job training and close supervision.

JOB TITLES AND DUTIES

EOD supervisory personnel at Holloman AFB are directly responsible for the proper handling of explosive ordnance. The duties, responsibilities, and qualifications of these position are as follows:

Air Force EOD Supervisor

Responsibilities: Directs the operations at the EOD section at Holloman AFB. The EOD supervisor provides assistance and guidance on explosive ordnance disposal and management at the EOD areas.

Duties:

The Holloman Air Force Base EOD Supervisor plans, coordinates, and directs all EOD operations at Holloman AFB. Interprets regulations and develops necessary operating procedures as required. Determines requirements for manpower, space, and equipment and initiates actions required. Determines the need for modifications to existing facilities and initiates action to improve economy, efficacy safety, and physical security of operations. Develops appropriate requirements and initiates requests for work.

Personal contacts: Maintains personal contacts with local and state government agencies and military commands.

Work assignment and review: Assigns work to subordinate employees or supervisors based on priorities. Makes decisions on work problems referred by subordinate supervisors. Assures that workload and project responsibilities are specifically delegated and assigned to subordinates.

TRAINING CONTENT, FREQUENCY, AND TECHNIQUES

EOD Training Program

This program is taught at Indian Head, Maryland, and is for all EOD personnel within the Department of Defense (**DOD**). All personnel must pass the basic course and supervisor personnel must pass the two additional advanced courses. All EOD personnel are required to complete annual reviews of the basic course. The course outline is as follows:

I. Explosive Ordnance Disposal Specialist/Technician Career Field:

A. Progression in career ladder 464X0
B. Duties of AFSCs 46430/50/70
C. History of Air Force EOD Program

II. Security:

A. Communications Security (COMSEC)
- **(1)** Classify information and use MAJCOM/SOA EEFIS
- **(2)** Prevent security violations
- **(3)** Observe security precautions

B. Operations Security (OPSEC)
- **(1)** Background and history of OPSEC
- **(2)** Definition of OPSEC
- **(3)** Relationship of OPSEC to other security programs including COMSEC, Information Security, and Physical Security
- **(4)** Common OPSEC vulnerabilities
- **(5)** OPSEC significance of unclassified data and procedures
- **(6)** Specific OPSEC vulnerabilities of AFSC 3E8X1

C. Security Requirements for EOD Publications
- **(1)** Storage requirements
- **(2)** Control/Access procedures

(3) Destruction/Disposition requirements
(4) Transportation Requirements
(5) Security Deviation Reporting

D. Protection of firearms and munitions

III. Air Force Occupational Safety and Health

A. The USAF program
B. Hazards of AFSC 3E8X1
C. AFOSD Standards for AFSC 3E8X1
D. Use of personal protective equipment
E. Fire prevention
F. Nuclear surety
G. Mishap reporting and investigation

IV. Publications

A. USAF administrative publications
B. USAF technical orders (TO)
(1) USAF TO system
(2) Use indexes (NI & RI)
(3) Locate desired information
(4) Use TOs when performing tasks
(5) Establish and maintain TO files
(6) Initiate TO improvement reports
(7) Requisition TOs

C. Use TOM sub-module for posting and tracking USAF TOs

V. Participate in USAF Graduate Evaluation Program

VI. EOD Flight Management

A. EOD Unit Management
(1) Organizational structure
(2) Functions and responsibilities
B. Inspection system
C. Material deficiency reporting

VII. Applied Principles of Physics

A. Properties of matter
B. Laws of motion
C. Simple machines
D. Measurement systems
(1) English
(2) Metric

(3) Conversion from one system to another

VIII. Fundamentals of Electricity

A. Demolition circuitry
B. Perform grounding procedures
C. Apply electromagnetic radiation precautions

IX. EOD Tools and Equipment

A. Maintain tools
B. Common handtools
(1) Select proper tools
(2) Use tools properly
C. Special tools and equipment
(1) Select proper tools
(2) Use tools properly
D. EOD MK-Series tools
(1) Select proper tools
(2) Use tools properly

E. Use the RIC sub-module for equipment maintenance and tracking

X. Military Explosives and Propellants

A. Identification
B. Effects
C. Application and use

XI. Destruction of Explosive Material and Related Hazardous Materials

A. Transportation

B. Firing systems
(1) Electric
(2) Non-Electric

C. Disposal procedures
(1) Routine
(2) Emergency

D. Munitions residue
(1) Inspect
(2) Certify
(3) Disposition

E. Environmental protection
- **(1)** Considerations
- **(2)** Use of EPA 8700-22 manifest
- **(3)** EPA permits and applications
- **(4)** Identify environmental impacts caused by EOD
- **(5)** Identify EPA regulations and directives pertaining to EOD operations
- **(6)** Determine EPA documentation requirements
- **(7)** Identify responsibilities of interfacing agencies

XII. Render Safe Techniques

A. Immobilize fuses
B. Remove fuses
C. Disable electrical components
D. Disrupt firing trains
E. Use shaped charges and demolition techniques

XIII. Chemical and Biological Warfare Agents

A. Classification
- **(1)** Types
- **(2)** Physical state
- **(3)** Physiological action
- **(4)** Persistency

B. Use protective clothing and equipment
C. Seal and package leaking munitions
D. Use detection and identification kits
E. Apply first aid/self air procedures
F. Use decontaminants and decontamination equipment

XIV. Placed Munitions

A. Land mine and fuses
- **(1)** Location
- **(2)** Identification
- **(3)** Observe safety precautions
- **(4)** Render safe
- **(5)** Perform disposal procedures

B. Booby traps and fuses
- **(1)** Classification
- **(2)** Identification

XV. Projected Munitions, Rockets, and Grenades

A. Projected munitions and their fuses
- **(1)** Observe safety precautions

(2) Identification
(3) Locate
(4) Render safe
(5) Disposal

B. Projected munitions, rockets, and grenades of foreign countries
(1) Observe safety precautions
(2) Identification
(3) Locate
(4) Render safe
(5) Disposal

XVI. Dropped Munitions

A. Bombs and bomb fuses
(1) Observe safety precautions
(2) Identification
(3) Render safe
(4) Disposal

B. Dispensers and payload
(1) Observe safety precautions
(2) Identification
(3) Render safe
(4) Disposal

XVII. Aircraft Weapons Systems and Explosives

A. Aircraft egress/weapons systems
(1) Aircraft/egress
(2) Gun systems
(3) Release and launching systems
(4) Missile/rocket launching systems
(5) Miscellaneous explosive-actuated devices

B. Aircraft explosive devices
(1) Locate
(2) Identify
(3) Observe safety precautions
(4) Render safe

XVIII. Pyrotechnics

A. Identify
B. Observe safety precautions
C. Render safe
D. Disposal

XIX. Guided Missiles

- **A.** Classification
- **B.** Identification
- **C.** Propulsion Systems
  - **(1)** Identification
  - **(2)** Characteristics
- **D.** Hazardous missile components and propellants
  - **(1)** Identification
  - **(2)** Render safe
  - **(3)** Removal
  - **(4)** Disposal
- **E.** Guided missiles of foreign countries

XX. Explosive Ordnance Reconnaissance

- **A.** Recognition of terrain changes due to unexploded ordnance (UXO)
- **B.** Locate, mark, and report UXOs
- **C.** Estimate collateral damage
- **D.** Technical intelligence
  - **(1)** Use photographic equipment
  - **(2)** Reporting

XXI. Access and Recovery

- **A.** Characteristics of soils
- **B.** Effects of weather on soils
- **C.** Methods of gaining access
- **D.** Performing field rigging and improvised hoisting
- **E.** Tie knots, bends, and hitches

XXII. Ranges

- **A.** Decontaminate ranges
  - **(1)** Active
  - **(2)** Inactive
  - **(3)** Excess
- **B.** Proficiency training and demolition ranges
  - **(1)** Establish
  - **(2)** Maintain

XXIII. Improvised Devices

- **A.** Locate
- **B.** Gain access
- **C.** Identify
- **D.** Interpret radiographs

E. Observe safety precautions
F. Render safe
G. Perform disposal procedures

XXIV. Base Recovery After Attack

A. Concept
B. Responsibilities
C. Pre-attack EOD procedures
D. Post-Attack EOD procedures
E. Munitions clearance vehicle CONOPS

XXV. Peace Time Operations

A. Develop plans for range clearance operations
B. Develop plans for ammunition disposal report operations
C. Use of demolition techniques

XXVI. Communications/Electronics

A. Tactical radios
B. Global positioning system
C. Frequency management requirements

XXVII. Render Safe Techniques

A. Immobilize fuses
B. Remove fuses
C. Disable electrical components
D. Disrupt firing trains
E. Use shaped charges and other explosive techniques

XXVIII. Case Attack Procedures

A. Use SMUD techniques
B. Use thermal techniques
C. Use shaped charges and other explosive techniques

XXIX. US and Foreign Underwater Ordnance

A. Identify
B. Observe safety precautions

XXX. New EOD Developments

XXXI. General Contingency Responsibilities

A. Prime BEEF orientation

B. Field sanitation and hygiene
C. Self-protection from extreme weather
D. First aid techniques
E. Personnel/work party security
F. Convoy security
G. Air base ground defense interface
D. Passive defense
I. Terrorism
J. Base denial

RCRA TRAINING PROGRAM

All EOD personnel responsible for management and operations at the 20,000-Pound OD Unit are required to complete the RCRA training program offered at Holloman AFB. The course outline is provided as Table D-1.

TRAINING DIRECTOR

The EOD supervisor is responsible for ensuring that assigned personnel receive adequate training in handling potentially hazardous wastes. Training directors at the EOD school in Indian Head, MD, are highly trained career specialists who provide the EOD training for all DoD personnel. Records of previous and ongoing training courses are maintained at the EOD section.

RELEVANCE OF TRAINING TO JOB POSITION

The EOD supervisory personnel who will be responsible in case of an emergency have been trained in handling explosive ordnance and potentially hazardous waste and in responding to emergency situations. Each has attended the EOD school course at Indian Head Naval Ordnance Station. Completion of the RCRA training course outlined in Table D-1 is also required.

TRAINING FOR EMERGENCY RESPONSE

The Naval Ordnance Station training program ensures that personnel receive emergency response training.
On-the-job training requires each person to read and understand various official publications including, but not limited to:

AFR 127-100	Explosives Safety Standards
AFOSD Regulation 127-66	General Industrial Operations
Code of Federal Regulations, Title 49	Transportation

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
T.O. 00-5-1	AF Technical Order System
T.O. 11A-1-1	Ammunition Restricted or Suspended
T.O. 11A-1-42	General Instructions for Disposal of Conventional Munitions
T.O. 11A-1-46	Fire Fighting Guidance, Transportation and Storage, Management Data, and Complete Round Charts
T.O. 11A-1-53	General Instructions for Ammunition Color coding, Identification of Empty and Inert Loaded Ammo Items and Components, and Assignment of Version Numbers to Training and Dummy Ammunition Items
T.O. 11A-1-60	General Instructions for Inspection of Reusable Munitions Containers and Scrap Material Generated from Items Exposed to or Containing Explosives
T.O. 60 Series	This series is common to all military services. Various titles regarding specific items containing explosive ordnance, e.g., T.O. 60B-2-2-11-4 (Mk 106 Practice Bomb), T.O. 60F-2-2-1-7 (2.75 WP Warhead)

Additionally, EOD personnel responsible for operations at the EOD Area are provided additional training in emergency response as a portion of the Holloman AFB training program. This training includes the following applicable Air Force Occupational, Safety, and Health Standards".

AFOSD 111-1
AFOSD 127-31
AFOSD 127-38
AFOSD 127-43
AFOSD 127-66

IMPLEMENTATION OF THE TRAINING PROGRAM

The EOD supervisor and director of the Holloman AFB RCRA training program will ensure that all EOD personnel have met the training requirements within six months of this assignment at the facility. At the time of the submittal, all EOD personnel have completed the hazardous waste management portion of the training program. Training records for both the EOD and RCRA portions of the program are maintained at the EOD and Environmental Planning Branches.

Annual reviews and updates are required for both the EOD and hazardous waste management portions of the program. Records that specify the job title, duties, and progression in the training programs are maintained at the EOD branch. These records are maintained during tenure of the personnel at Holloman AFB.

Table D-1

Hazardous Waste Training Outline

1. This training is provided primarily to accumulation/satellite accumulation point managers. This course is designed to fulfill, in part, the requirements of 40 CFR 265.16.

2. The following material is covered during the class:

A. Introduction to RCRA

B. Definition of Hazardous Waste
- characteristics
- listed wastes

C. Accumulation point managers

D. Container use, marking, labeling and on base transportation

E. Contingency planning and emergency response.

ATTACHMENT E

CONTINGENCY PLAN

Introduction

The following information outlines the procedures for responding to an emergency at Holloman Air Force Base (**HAFB**) involving hazardous waste at the OD Unit, and was provided to HRMB in accordance with the requirements of 20 NMAC 4.1, Subpart V, §264.50-56:

General Information

This Contingency Plan is designed to minimize hazards to human health and the environment from emergencies that may occur as a result of managing hazardous wastes (ordnance materials) at the Holloman AFB 20,000-Pound OD Unit. The ordnance materials are solids which demonstrate the hazardous characteristic of reactivity. Emergency events that could occur would be an uncontrolled explosion, an accidental fire, or a diesel fuel spill.

This Contingency Plan will be reviewed and, if necessary, amended whenever any of the following occurs:

- The facility permit is revised;
- The plan fails in an emergency;
- Design or operation of the facility changes significantly such that implementation of the Contingency Plan would be affected;
- List of emergency coordinators changes; or
- List of emergency equipment changes.

Activities at the OD Unit consist of detonation of ordnance materials which are considered to be hazardous wastes due to their exhibiting the characteristic of reactivity (EPA Hazardous Waste Code D003). As evidenced by the chemical composition information contained in the Waste Characteristics section, Permit Attachment A, the ordnance materials contain relatively few hazardous constituents that would persist after detonation and the constituents are relatively immobile. Consequently, the only immediate threat to human health or the environment as a result of activities at the OD Unit is an uncontrolled explosion, an accidental fire, or a diesel fuel spill.

The primary mission of the OD Unit is to render safe reactive materials at Holloman AFB that have exceeded their shelf life, deteriorated unexpectedly, are damaged, or failed to attain specifications. In the event that an uncontrolled explosion occurred at the OD Unit, the exploded materials would not present a danger to human health or the environment outside the immediate area of the OD Unit. In that event, additional explosive ordnance disposal (**EOD**) personnel would be dispatched to the OD Unit to render safe any unexploded ordnance material that may be present following an uncontrolled explosion.

There is a fire response station located at Holloman AFB. Fires that occur at Holloman AFB are handled by Fire Protection Flight at Holloman AFB. Additionally, Holloman AFB maintains a Disaster Control Group which can also respond to fire emergencies. For fire emergencies that are extremely large, Holloman AFB has agreements with the cities of Alamogordo, Cloudcroft, and Alamo West to use their volunteer fire departments.

In the event of a diesel fuel spill, Fire Department personnel will respond. EOD personnel maintain additional spill response equipment and are trained in diesel fuel spill response.

The overall approach for emergency response at Holloman AFB is through a hierarchy of personnel for responding to emergencies throughout the Base as detailed in HAFB's Base Civil Engineer Contingency Response Plan. The procedures outlined in this Contingency Plan are developed to specifically detail the procedures for an emergency involving hazardous waste at the OD Unit.

Copies of this plan, as well as updates, are kept with the primary and secondary emergency coordinators as well as with the on-post police, fire department, and hospital (49th Fighter Wing Hospital).

Emergency Coordinators

The primary Emergency Coordinator at Holloman AFB is the Commander of the 49th Support Group. The Commander has a detailed knowledge of: hazardous waste operations at Holloman AFB; layout and operations at the OD Unit; and the emergency response procedures of the Contingency Plan and the Spill Prevention and Response Plan. The Emergency Coordinator has the authorization to commit all resources necessary for emergency response activities. Either the Emergency Coordinator or the secondary Emergency Coordinator is on-site or on-call at all times. The Commander's on-base extension is 5541.

The secondary emergency coordinator at Holloman AFB is the Base Civil Engineer. The on-base extension for the Base Civil Engineer is 3071. In addition to these two emergency coordinators, Holloman AFB has Environmental and Engineering Flight teams trained in emergency response, as well as a Base fire department and a disaster control group. These groups, as needed, assist in emergency situations at the OD Unit. However, the EOD personnel would be the primary support for an emergency situated at the OD treatment unit.

Implementation of the Contingency Plan

The Contingency Plan will be implemented immediately whenever there is an accidental fire, spill, or uncontrolled explosion which could threaten human health or the environment. Such a fire would be defined as one that had spread outside the boundaries of the OD Unit to an extent that Holloman AFB personnel and equipment could not provide adequate containment.

Emergency Response Procedures

During an event not requiring implementation of the Contingency Plan, EOD personnel will alert Test Track personnel and the fire department via portable radio.

During an emergency situation which requires implementation of the Contingency Plan, the emergency coordinator would implement the following first level response procedures:

- Activate internal communications systems to alert emergency response personnel;
- Identify the character, exact source, amount, and areal extent of the released materials;
- Assess possible hazards to human health and the environment (both on-installation and off-installation);
- Take steps to mitigate the spread or reoccurrence of the fire;
- Notify appropriate state or local agencies, if needed;
- Assess possible hazards to human health or the environment as a result of the fire; and

- Remove/transport any untreated ordnance material if the fire occurs while ordnance material is still present at the site.

If, based on the assessment of possible hazards, the emergency coordinator determines that the fire could threaten human health or the environment on-installation, he would immediately notify the military police. If evacuation is considered necessary, the emergency coordinator would confer with military police on which areas should be evacuated. If, in the unlikely event that the emergency coordinator determines that the fire could threaten human health or the environment off-installation, he would immediately notify local authorities. If evacuation is considered necessary, the emergency coordinator would confer with local authorities and with military police on which areas should be evacuated. The emergency coordinator will also notify the National Response Center at 1-800-424-8802 and provide the Center with the following information:

- Name and telephone number of the reporter (emergency coordinator making the notification);
- Name and address of the facility (Holloman Air Force Base, Alamogordo, New Mexico);
- Time and type of incident (fire);
- Name and quantity of materials involved;
- The extent of injuries, if any; and
- The possible hazards to human health or the environment outside the facility.

If evacuation is required, the evacuation plan consists of military police providing direct notification to persons in the likely path of the fire to evacuate. However, no residential areas exist near the OD Unit, and the possibility of fire spreading to residential areas is extremely unlikely.

Emergency Response Equipment

Holloman AFB maintains a large inventory of equipment that can be used as emergency response equipment. Although this equipment is not dedicated solely for hazardous waste service, it can be used in response to a fire involving hazardous waste. A listing of the equipment that is available, numbers of items, and the locations of that equipment are included in the remainder of this

Contingency Plan that begins from "Contingency Response Plan" which is presented below. After use, all durable emergency response equipment must be cleaned, inspected, and fit for its intended use prior to resuming operations at the OD Unit. All non-durable emergency response equipment which is disposed of must be replaced as soon as practicable.

Coordination Agreements

Holloman AFB maintains a full spectrum of emergency response services at the installation including a fully equipped fire response station, emergency medical services, military police, and a hospital (49th Medical Wing Hospital). These installation organizations have been contacted to familiarize responders with operations at the OD Unit. Arrangements have been made with these departments and they have been familiarized with the Contingency Plan. Although the capabilities of Holloman AFB exceed those of local emergency response services, arrangements have been made with the local volunteer fire departments in the cities of Alamogordo, Cloudcroft, and Alamo West to provide Holloman AFB with back-up fire fighting skills, if needed.

Required Reports

Holloman AFB will note in their operating record the time, date, and details of any incident which requires implementation of the Contingency Plan. Within 15 days after an event which requires implementation of the Contingency Plan, an incident report will be prepared detailing the event and submitted to the Region VI Regional Administrator of the EPA and the New Mexico Environment Department. The report will include the following information:

- Name, address, and telephone number of Holloman Air Force Base;
- Date, time, and type of incident;
- Name and quantity of materials involved;
- The extent of injuries, if any;
- An assessment of actual or potential hazards to human health or the environment, where applicable; and
- Estimated quantity and disposition of recovered material that resulted from the incident.

CONTINGENCY RESPONSE PLAN

The information contained in the following paragraphs is adopted from the Holloman AFB Base Civil Engineer Contingency Response Plan. The plan is divided into seven sections that identify:

- overall mission;
- designated parties and their responsibilities;
- emergency response, control, and countermeasures;
- contingency plan requirements and actions;
- contingency training; and
- plan review and update.

Additionally, the Contingency Response Plan provides a series of annexes that identify contingency requirements for specific and other nonspecific base locations. Annex D-1-B is primarily used in conjunction with the sections of the Contingency Response Plan indicated above in response to emergencies involving the OD Unit. The Contingency Response Plan is kept updated by Holloman AFB and provides guidelines for dealing with hazardous waste-related emergencies.

GENERAL INFORMATION

This contingency plan will be reviewed continually and revised if any of the following occur: the facility permit is revised; the plan is inadequate in an emergency; the procedures herein can be improved; facility operations change in a way that alters the plan; the emergency coordinator changes; or the emergency equipment list changes. Amendments to this plan can be initiated by any responsible party. Proposed changes may be submitted to the 49th Civil Engineering Squadron (49 CES) as the office with primary responsibilities to represent both EOD personnel and other contingency response personnel. Adopted changes will be provided to all record holders of this permit.

Copies of the Contingency Plan will be available at the Holloman AFB civil engineering office and the base EOD office.

The facility name, address, ID number, and owner/operator are provided below:

- Name: Holloman Air Force Base
- Owner: United States Air Force
- Operator: 49 CES/CEV
- EPA ID No: NM6572124422

EMERGENCY COORDINATORS

The emergency coordinators will coordinate and direct control and cleanup efforts at the scene in case of an incident involving the transportation, handling, or demolition of explosive waste items. The emergency coordinators can designate other personnel to assist them in the event of an emergency and have the full authority to obtain fire and medical support service should the need arise.

Prior to operations by EOD personnel, the EOD supervisor contacts the following base offices: meteorology, munitions, medical services, security police, base operations, Environmental Coordinator, and the fire chief. Therefore, the capabilities of these organizations are alerted in the event that potential emergencies occur during EOD treatment operations.

The primary on-scene coordinator (**OSC**) for Holloman AFB is the Commander, 49th Support Group. The title and work phone number of the primary OSC and designated alternates are provided below:

Title	Base Phone No.
Commander	(505) 475-5541
Base Civil Engineer	(505) 475-3071
Chief of Maintenance Engineering	(505) 475-5038
Chief of Readiness Flight	(505) 475-3066
Command Post	(505) 475-7575

IMPLEMENTATION

The decision to implement the Contingency Plan for the unit depends upon whether an imminent or actual incident could threaten human health or the environment.

The purpose of this section is to provide guidance to the emergency director in making this decision by providing decision-making criteria.

The Contingency Plan will be implemented in the following situations:

- An unplanned fire or unplanned explosion occurs at the OD Unit such that:
  - the potential for human injury exists;
  - toxic fumes that could endanger human health or the environment are released;
  - the fire could spread on-site or off-site and possibly ignite other flammable materials or cause heat-induced explosions;
  - the use of water and/or chemical fire suppressants could result in contaminated runoff that could endanger human health or the environment; or,
  - an imminent danger exists that an explosion could ignite other hazardous wastes at the facility and possibly result in the release of toxic material.
- A spill or unplanned release of hazardous material occurs at the unit such that:
  - the spill could cause the release of toxic liquids or fumes that could endanger human health or the environment;
  - the spill cannot be contained in the immediate areas resulting in potential off-site soil contamination and/or ground or surface water pollution that could endanger human health or the environment; or,
  - the spilled material inadvertently detonates or is combustible.
- A fire or explosion occurs during transportation of the waste or residuals to or from the unit.
- A planned treatment event results in:
  - damage to the unit beyond that normal to such treatment event and such that release is imminent; or
  - ignites any structure, road surface, etc. in the vicinity.

- During rupture of a cylinder, the cylinder is released from its securing device.

EMERGENCY RESPONSE PROCEDURES

Notification

The EOD team members discovering a potential emergency incident at any of these units will notify Range Control Supervisor. The Range Control Supervisor will, in turn, notify the on-scene commander (**OSC**) or alternate. The OSC or alternate will immediately activate the internal alarm system to notify or evacuate personnel, if appropriate. In addition, the OSC or alternate will notify the Base Fire Chief, Environmental Coordinator, Base Civil Engineer, Chief of Operations, Readiness Flight, Material Management, Engineering and Environmental Flight, Public Affairs, and Medical Services as required.

The appropriate local agencies with designated response roles will be notified by the OSC if their help is needed. The appropriate state agencies will be notified if their assistance is needed, or the incident requires reporting at this level.

The evacuation routes to be used in the event of an emergency, are the unit entrances, provided that the extent of the incident is limited to the immediate vicinity but temporary evacuation is required. Evacuation from the main base area, if required, is designated in the Holloman AFB Contingency Response Plan.

IDENTIFICATION OF HAZARDOUS WASTES

The OSC will immediately identify the character, exact source, amount, and a real extent of the material involved in the unplanned incident. The initial identification method will be by visual inspection of the incident's effects, spilled material, and location of the release. Plan records, including inventories and process and waste log sheets, are available at the EOD and Base Environmental Coordinator's office to aid in estimating the composition and quantity of released material.
Base Bioenvironmental Engineering personnel will sample the released material to verify hazardous material identification, to determine boundaries of contaminated areas and contaminant concentrations, and to verify that proper cleanup activities are completed.

Resources such as plant storm-line diagrams and material-storage locations are available at the Base Operations office and will be utilized to determine control procedures.

HAZARD ASSESSMENT

Possible hazards to the environment and public health will be assessed by the OSC, and the need for local evacuation and notification of local authorities will be determined. In assessing the situation, the OSC will consult with the Environmental Coordinator, Bioenvironmental Engineer, and Base Fire Chief. These parties will consider both direct and indirect effects of the event on human health, welfare, and natural resources. In assessing the event, the potential for direct and indirect effects shall indicate, but not be limited to, fire, explosion, further release occurrence, toxic gases, or injection by run-on and run-off. Action will be taken to control releases and minimize effects during such an emergency, if the situation involves the release or potential release of toxic effluent.

The OSC, in conjunction with the noted personnel, will determine whether the OD Unit has had a release which could threaten human health or the environment outside the base. Bioenvironmental Engineering personnel will survey the area and advise the OSC in the establishment of protective boundaries around the contaminated areas.

If a release results in a vapor cloud, several methods are available for assessing the hazards. Portable equipment for direct air monitoring can be used to make a rapid determination of the most volatile organics.

Meteorological data, including wind speed, wind direction, temperature, dew point, barometric pressure, and an automatically-calculated stability factor are continuously available from base meteorological towers. These data, along with information about the source of an atmospheric release, can be used to predict the direction, extent, and estimated concentration profile of a contaminated release.

If the assessment of the incident indicates that evacuation of areas downwind of the unit may be advisable, the OSC will immediately notify HQ ACC/CEV and the appropriate local authorities. He will consult with these officials to help decide whether local areas should be evacuated. The OSC or the Environmental Coordinator will immediately notify the National Response Center (using their 24-hour toll free number, 800-424-9902.

CONTROL PROCEDURES

Potential accidents at the OD Treatment Unit can be considered either unplanned fire/explosion, inadvertent facility damage, or spill material release. Natural disasters such as earthquakes, hurricanes, or tornadoes are not assumed to cause actions which fall into one of these categories. Procedures for responding to these incidents are contained in the Contingency Response Plan, Disaster Preparedness Plan, and TO 11A-1-60. Specific actions to be taken at these units include:

- **Ordnance Transportation Vehicles**

  - **Explosion.** In the event of an explosion, personnel will immediately withdraw to a safe distance and evaluate the situation. NOTE: This does not apply to detonation during transport which requires immediate implementation of the referenced Contingency Response Plan and Disaster Plans. Heavy-bodied trucks have been specifically chosen for this task due to the inherent risk associated with these materials. Transport limits and requirements are specified in relevant EOD technical orders.

  - **Fire.** In the event of a fire involving a transport vehicle with ordnance on-board, an attempt to control the fire with available extinguishers may be permissible if the fire is initially away from the ordnance. If not, personnel will withdraw to a safe distance and advise appropriate authorities.

  - **Material Spill.** In the event of a diesel fuel spill, shovels will be used to construct a dike around the spill to contain lateral movement. As much free liquid as possible will be returned to the container. The fuel-soaked soil will be excavated and placed in impervious recovery containers for transportation to an approved disposal location. The Base Environmental Coordinator will be contacted for disposal information.

PREVENTION OF RECURRENCE OR SPREAD OF FIRES, EXPLOSIONS, OR RELEASES

The Holloman Contingency Response Plan should be referenced for this information. At a minimum, follow-up actions will include:

- Start actions to collect, treat, and dispose of nonexplosive waste or other materials as appropriate. This will be a joint operation involving EOD, Fire, and Bioenvironmental Engineering personnel.

- Ensure that EOD, Fire, and Safety personnel investigate the cause of the emergency and provide a technical report to the Commander, 49th Support Group within 72 hours.

- Ensure that proper restoration actions are started as soon as possible after appropriate explosives decontamination procedures have been completed. This will be a joint operation between Safety and Civil Engineering personnel for Air Force incidents. All decontamination actions will be documented and the records permanently maintained at Air Force EOD, Safety, and Real Estate offices.

- Ensure that equipment repaired or replaced as a result of the incident is recertified, as necessary, prior to being placed.

STORAGE AND TREATMENT OF RELEASED MATERIAL

The storage and treatment of any released material will be managed in accordance with the Holloman Contingency Response Plan.

POST-EMERGENCY EQUIPMENT MAINTENANCE

Post-emergency equipment maintenance will be performed in accordance with the Holloman Contingency Response Plan.

CONTAINER SPILLS AND LEAKAGE

Any container spills or leakage which might occur at these units will be managed in accordance with the Holloman Contingency Response Plan.

EMERGENCY EQUIPMENT

The following items will be available for EOD activities:

- first aid kit (NSN-654500-116-1410) or suitable substitute;

- ambulance or first aid vehicle;
- fire extinguisher: two per vehicle carrying class B/C explosives;
- hand-held radio for contact with range control;
- vehicular radio for contact with Holloman AFB;
- team chief's response kit with maps;
- road kit: one per vehicle;
- general purpose tool kit;
- signal kit;
- pioneer tool kit (if required for specific treatment event);
- road flares;
- shovels: two per vehicle; and
- bulldozer.

COORDINATION REQUIREMENTS

In addition to the base organizations and personnel assigned to the response effort, provisions have been made for including off-base organizations in the response organization when on-base response resources and expertise are insufficient, and when off-base water, land, or air are adversely affected. Some of the significant off-base response resources that can be incorporated, as needed, are discussed in the paragraphs below.

a. Air Combat Command (ACC/CEV):

MAJCOM office responsible to ensure environmental protection including spill response matters. This office is located at Langley AFB, VA and can be reached at DSN 574-2601 or commercial 804-764-2601.

b. Air Force Engineering and Services Center (AFESC):

The Air Force Engineering and Services Center is assigned the responsibility to provide technical guidance and assistance to major commands and bases in contingency operations and environmental planning. Technical expertise can be provided to

the Air Force OSC on hazardous material identification, control, cleanup, and disposal. The AFESC/CEVP is located at Tyndall Air Force Base, Florida, and can be contacted at DSN 970-6167 or commercial (904) 283-6167.

c. State of New Mexico Response Team:

The New Mexico Environment Department (NMED) has developed an Emergency Response Team to respond to spills occurring within the state boundaries. The state on-scene commander **(OSC)** will be briefed fully by the base OSC on the spill response. The state OSC will be familiar with the available sources of spill response equipment and materials within New Mexico. The NMED emergency response team phone number is (505) 827-9329.

d. City of Alamogordo Fire Department:

Holloman AFB has mutual aid agreement with the city of Alamogordo Fire Department (located about 7 miles east of HAFB) to provide assistance in the event it should be needed.

e. White Sands Missile Range:

Certain information services are also available to assist in the event of an emergency. They include:

- CHEMTREC
- CHRIS Manual
- ETRIS
- OHMTAPS
- U. S. Air Force Occupational and Environmental Health Laboratory

Further information on these services is provided in the Contingency Response Plan.

EVACUATION PLAN

It is extremely unlikely that emergency operation at the OD Unit would require evacuation of other areas at Holloman AFB since these units are isolated from any other area or office buildings.

The general base excavation plan is provided as part of the Disaster Preparedness Plan.

REQUIRED REPORTS

The emergency coordinator will notify the Holloman AFB Environmental Coordinator (49th CES/CEV) who will report pollution incidents as necessary.

Notification by the environmental coordinator (DEV):

1. All pollution incidents will be reported as soon as practicable, by telephone during duty hours or by message during off-duty hours, to the following agencies:

a. HQ ACC/CEV
DSN 574-2601; commercial (804) 764-2601

b. Regional Response Center (RRC)

Environmental Protection Agency, Region VI
First Interstate Bank Tower
1445 Ross Avenue
Dallas, TX 75202-2733
(214) 767-2666/2720
Telex 910-861-4125

c. New Mexico Environment Department
1-(505)-827-9329

2. Major spills or potentially major spills will immediately reported by telephone and teletype to RRC (1.b above) and:

National Response Center
Environmental Protection Agency
Nasiff Building
400 7th Street, S.W.
Washington, D. C. 20590
1-800-424-8802
Telex 426-0014

Medium spills will be reported to the above agencies as soon as practical.

PERMIT ATTACHMENT F

CLOSURE AND POST-CLOSURE CARE PLANS

This section contains the closure plan, contingent post-closure plan, and financial assurance information for the 20,000 Pound OD Unit at Holloman Air Force Base (**HAFB**) and was submitted in accordance with the requirements of New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V, 40 CFR §264.110 through §264.115, Subpart IX, § 270.14(b)(13), and §270.14(b)(15) through (18).

This closure plan identifies the closure process to be employed at the OD site where these activities occur at any point during the site's intended operating life or for closure at the end of the operating life.

Closure Performance Standard

This closure plan is designed to ensure that the 20,000-Pound OD Unit will not require further maintenance and controls, will minimize and eliminate threats to human health and the environment, will prevent the escape of hazardous wastes, hazardous constituents, or waste decomposition products to soils, surface waters, groundwater or the atmosphere, and will comply with all relevant closure requirements. To achieve this standard, measures taken during the active life as well as those that will be conducted during closure have been formulated specifically to address these criteria.

Summary of Activities Conducted During Active Life

During the active life of the OD unit, the post-treatment residuals and soils will be sampled quarterly to demonstrate treatment effectiveness and ensure that residuals are nonhazardous. During the interim period between treatment events, the unit will be periodically graded and residuals in the unit will remain covered to retard leachate formation and prevent wind dispersal. Quarterly, residuals and soils will be sampled for characteristics of hazardous waste and suspected hazardous constituents, as specified in the Sampling and Analysis Plan **(SAP)**, Permit Attachment J. The SAP documents all of the protocols used during active-life sampling events.

Summary of Closure Activities

At the conclusion of the final OD treatment event, the site will be inspected and all debris will be removed. Following these activities, representative samples from across the entire 20,000 Pound OD Unit will be collected and analyzed to determine the residual concentrations of any toxic metals and explosive compounds, if any. These analytical results will be compared to background levels or risk-based criteria deemed to be protective of human health. If all levels are determined to be below background (for metals) or the analytical detection limits (for organics), the closure will be considered clean closure. If levels are detected in excess of background or detection limits but are below risk-based criteria, the closure will be considered a risk-based closure.

In the event that an area of the unit is determined to contain levels in excess of risk-based criteria, further action will be taken as necessary in coordination with NMED prior to completing closure, such as risk assessment, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. When all such activities have been completed as required, and all samples show that the residual levels of contamination are below the risk-based criteria, all remaining closure and post-closure activities will be completed, including grading, decontamination, and closure certification. More detailed descriptions of the specific activities that will be conducted to ensure that the closure performance standard is met are presented in the following sections.

Partial and Final Closure Activities

There will be no partial closure of the OD treatment unit.

Maximum Waste Inventory

Operating practice precludes the storage of hazardous wastes at the 20,000-pound OD Unit. For safety reasons, waste munitions will be treated as received or as generated and no other wastes are stored at the site. During operation, the maximum amount of hazardous wastes treated during a single OD event at any time during the life of the facility is 20,000 pounds NEW of waste munitions. No waste munitions will be present at the site upon initiation of closure activities.

Inventory, Removal, Disposal, and Decontamination of Equipment

As outlined in above, the steps to achieve the closure standard include site reconnaissance, removal of scrap materials and debris, closure sampling and analysis, risk-based screening, corrective action (if needed), surface grading, decontamination, and closure certification. Appropriate personal protective equipment **(PPE)** will be worn during each of these steps. Each step is discussed in detail below.

Site Reconnaissance

Following the final treatment event, the unit will be inspected to ensure that the planned closure approach can be implemented. The inspection will consist of a visual site inspection (VSI) to identify the location of any scrap materials, debris, or any other substances that may impede closure of the unit. All materials that need to be removed prior to proceeding with closure will be documented in a field inspection logbook.

Removal of Scrap Materials and Debris

On the basis of the VSI, any identified scrap, debris, or other substance that could impede closure of the unit will be removed and disposed of in accordance with applicable regulatory requirements. Because treatment may not render all the treated waste munitions nonhazardous, all fragments of unexploded ordnance, scrap materials and debris will be managed as appropriate.

Closure Sampling and Analysis

Following the final OD operational activities specified, representative soil samples from the 20,000-Pound OD Unit will be collected and analyzed to determine the residual concentrations of any toxic metals and high explosive (**HE**) compounds. Because abundant data will have been gathered during prior quarterly sampling events, and because it is important to verify that the entire area of the OD Unit has been adequately sampled, a non-stratified sampling approach will be used. For example, a geostatistical approach may be used for determining the placement and numbers of samples for closure. This approach will account for the spacing of previous samples and identify areas where additional sampling will be required. Once sampling location have been determined, hand auger samples will be collected from the surface interval (0-1 ft) at each of these locations and sent to an approved laboratory for analysis.

Analyses to be performed will include:

- SW7041 (antimony);
- SW7060 (arsenic);
- SW7421 (lead);
- SW7471 (mercury);
- SW7740 (selenium);
- SW6010 (metals); and
- SW8330 (explosives).

Because no materials other than waste munitions will be stored or treated at the OD site, no other analyses will be required. A complete description of the sampling and analysis protocol and rationale, including that to be followed during closure, is provided in Permit Attachment J.

Background Comparison and Risk-Based Screening

Following sampling and analysis, the analytical results will be compared to background results and with appropriate risk-based standards deemed to be protective of human health. In the event that a sample or area of the OD unit is determined to contain hazardous constituent levels in excess of these standards, NMED will be contacted to discuss further action prior to completing closure, such as risk assessment, confirmation sampling, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. When all such activities have been completed (as required) and all sample results show that the residual levels of contamination are below the risk-based criteria or are protective of human health and the environment, all remaining closure activities will be completed.

Corrective Action

If any sample or area is determined to contain contaminant concentrations in excess of the risk-based or cleanup levels, HAFB will submit a Corrective Action Workplan to NMED. Possible corrective actions could include risk assessment, confirmation sampling, delineation of the extent of the exceedence, (i.e., contamination plume), analysis of corrective measures, and corrective measures implementation. Any hazardous investigation-derived waste and/or remediation waste that is generated and exceeds the risk-based criteria will be stored at the HAFB Defense Reutilization and Maintenance Organization (DRMO) facility prior to shipment to an authorized disposal facility using an authorized transporter.

Surface Grading

Once all scrap materials and any other debris have been removed, and sampling results indicate that all remaining analytes are below health-based criteria, the unit will be graded to manage surface water infiltration and run-off while controlling erosion. Specifically, surface grading will reduce ponding and runoff velocities that can contribute to soil erosion, and will roughen and loosen soils to facilitate natural revegetation.

Decontamination

Following all the closure activities outlined above, all equipment will be washed with detergent and triple rinsed with water. All PPE and rinse water will be disposed of properly.

Schedule for Closure

As specified in 40 CFR 261.113(b), closure activities at the 20,000-Pound OD Unit will be completed within 180 days of treating the final volume of hazardous waste. No extension beyond the 180 days provided is being requested at this time; however, if it is determined that an extension is needed, this plan will be modified. Notification of intent to close will be submitted to the NMED, Hazardous and Radioactive Materials Bureau. The anticipated date for the initiation of closure activities is January 2006. Table F-1 presents an estimated closure schedule.

Certification of Closure

Upon completion of all activities, certification that the closure of the 20,000-Pound OD Unit was performed in accordance with a New Mexico approved closure plan will be submitted by registered mail to the NMED RCRA Program Manager and/or the EPA Regional Administrator no later than 60 days following completion of all closure activities. The certification will be signed by an authorized official of Holloman AFB and an independent New Mexico registered professional engineer. Documentation supporting the independent professional engineer's certification will be furnished to the NMED upon request.

Table F-1
Estimated Closure Schedule for the 20,000-Pound OD Unit

Closure Activity	Closure Period (Days)
Receive and treat final volume of waste	-10 to 0
Closure begins	0
Perform site reconnaissance	0 to 5
Remove scrap	5-15
Soil Sampling and Analysis	15-50
Address any exceedences of standard (if any)	50-130
Grade	130-140
Decontaminate equipment	140-150
Prepare closure certification/post-closure documentation	150-180
Submit closure certification/post-closure documentation	180
NMED issues post-closure permit	180-235
Conduct post-closure care activities	To Be Determined

Other Activities

In addition to the closure activities specified in earlier paragraphs, other tasks will be performed to ensure that the closure activities satisfy the closure performance standard. These tasks include periodic regrading and maintenance to retard erosion and run-on/run-off, and continued posting and security measures.

CONTINGENT POST-CLOSURE PLAN

Because some residues may remain in place, this contingent post-closure plan provides a description of the activities that may be conducted to ensure long-term reliability and effectiveness of the closure.

Post-Closure Care and Use of Property

The following sections describe the post-closure care period, site security during the post-closure period, and the post-closure use of the subject OD treatment unit.

Post-Closure Care Period

If any waste residues are left in place, contingent post-closure care activities will be required to ensure the long-term integrity of the closure and continued protection of human health and the environment. However, several factors suggest that the duration of any post-closure activities might be limited, including:

- The treatment activities render the waste munitions non-hazardous;
- The risk-based closure activities will ensure that no residues remain in concentrations exceeding established health-based criteria;
- The nature of the treatment, the waste residues, and the closure approach substantially minimize the likelihood of any contaminant migration; and
- Groundwater beneath Holloman AFB has been designated by NMED as unfit for human consumption due to levels of total dissolved solids that exceed human health standards.

Therefore post-closure care of the subject OD unit, and ground water monitoring at the site may continue for a period of at least 30 years after closure certification verification and issuance of a Post-Closure Care Permit under the provisions of 20 NMAC 4.1, Subpart V, 40 CFR §264.117.

Post-Closure Security

Although the closure plan will ensure that all contaminants are reduced to levels protective of human health and the environment and will minimize the potential for contaminant migration, because some residual contamination may remain in place, security that was used for the management of hazardous wastes will be provided during the contingent post-closure period to prevent access to the OD treatment unit.

The security mechanisms that will be in-place during the contingent post-closure period will include the following:

- Utilization of the Base's existing 24-hr security system (i.e., guards making routine rounds) to provide continuous monitoring of the unit; and

- Access control to the Base via fence, gate and other entry control devices.

In addition to these measures, the 20,000-Pound OD Unit will be clearly posted with signs that state, "DANGER—UNAUTHORIZED PERSONNEL KEEP OUT." These signs will be posted at all entrances and at other locations so as to be seen from any approach to the unit. The legend will be written in both English and Spanish and will be legible from a distance of 25 feet.

Post-Closure Use of Property

Uses of the property during the Post-Closure Care period will be in compliance with 20 NMAC 4.1, Subpart V, 40 CFR §264.117(c) and may not result in the disturbance of the final grading or vegetative cover. Post-closure use resulting in any disturbance will require a modification to the Post-Closure Care Permit and only be allowed to protect human health and the environment.

POST-CLOSURE CARE PLAN AND GROUND WATER MONITORING

Post-Closure care of the OD Treatment Unit will be conducted when it has been established that clean closure cannot be achieved. Four ground water monitoring wells MW-01 (upgradient), MW-02, MW-03, and MW-04 (downgradient) will be installed (See Figure G-5, Permit Attachment G). The ground water monitoring will be conducted for 30 years from the time of closure completion.

Post-Closure Maintenance Requirements

The majority of maintenance activities will be contingent upon the results of routine (quarterly) inspections. Maintenance activities include maintaining all site markings and other benchmarks, access control devices, and postings. Table F-2 outlines these activities and frequency of occurrence.

Certification of Post-Closure Care [20 NMAC 4.1, Subpart V, §264.120]

As with the closure plan, certification that all contingent post-closure activities for the 20,000 lb OD Unit were performed in

accordance with the specifications in the approved Post-Closure Care Plan will be submitted by registered mail to NMED no later than 60 days following completion of all post-closure activities. The certification will be signed by an authorized official of Holloman AFB and an independent New Mexico registered professional engineer. Documentation supporting the independent professional engineer's certification will be furnished to the NMED upon request.

SURVEY PLAT AND POST-CLOSURE NOTICES

As specified in 20 NMAC 4.1, Subpart V, §264.116 and §264.119, a survey plat and deed notification will be necessary to satisfy the closure and any contingent post-closure care requirements. Therefore, upon completion of all closure activities, a survey plat delineating the boundary of the closed 20,000 lb OD treatment Unit with the certification of closure will be submitted to the local zoning authority, the NMED, and the EPA. Following closure and post-closure care activities, Holloman AFB's deed will be amended to record the closed unit. This deed recordation will, in perpetuity, notify any potential purchaser of the property that the land has been used in the management of hazardous waste and its use is restricted as specified in 20 NMAC 4.1, Subpart V, 40 CFR 264.119.

Table F-2

Required Maintenance Activities and Schedule

Area/ Equipment	Specific Items	Types of Problems	Corrective Action	Frequency of Inspection
Security Devices	Fence	Broken/ Damaged	Repair immediately if damaged	Quarterly
	Access Gate	Locking mechanism jammed	Repair/replace	Quarterly
	Signs	Illegible	Replace	Quarterly
Final Cover/ Grading	Cover/ Grading Integrity	Subsidence, excessive bare soil, rodent burrows	Restore site to grade	Quarterly (immediately following any 10 year, 24-hour intensity rainfall event)
Run-on/Runoff Drainage Control	Drainage sloping and channels	Settlement, ponded water, blockage, erosion	Repair settlement and erosion, remove blockages	Quarterly
Benchmarks	Not Applicable	Damaged	Replace if Damaged	Quarterly

PERMIT ATTACHMENT G

FACILITY DESCRIPTION

Introduction

The following information was provided in accordance with the requirements of 20 NMAC 4.1, Subpart IX, 40 CFR §270.14(b)(1). A general description of the location of the subject OD unit is presented, followed by a presentation of the site characteristics. These include a summary of the land use patterns, climatic conditions, geology, pedology, hydrology, and wildlife.

GENERAL DESCRIPTION

Holloman Air Force Base **(HAFB)** is located on approximately 50,700 acres of land in Otero County, South-central New Mexico. The Facility lands are situated in the northern Chihuahuan Desert in the region known as the Tularosa Basin that is bounded to the east and west by the Sacramento and San Andres Mountains, respectively. The base is located adjacent to White Sands Missile Range and White Sands National Monument is located west of the Base. Regional water supplies are derived from Bonita Lake located approximately 60 miles north of the base and the Boles, Douglas, and San Andres Well Fields located 14 miles to the southeast.

The nearest population center to HAFB is the city of Alamogordo located approximately 7 miles to the east. Regional metropolitan centers include El Paso, Texas, located 75 miles south-southwest and Albuquerque, New Mexico, located 210 miles north of the facility. The primary transportation route for the facility is Highway 70 that traverses the southern boundary of the base in a northeasterly direction. The general location of HAFB is depicted in Figure G-1

HAFB was initiated as a temporary facility developed to provide gunnery and bomber training to aircrews during the Second World War. The Base mission was altered in the postwar years to the development of pilotless aircraft, guided missiles, and associated equipment. In the late 1950s the base was transferred to the Air Force Systems Command (AFSC) and designated as the Air Force Missile Development Center. On January 1, 1971 , the base mission expanded to provide lead-in fighter training for the 479th Tactical Training Wing and its components.

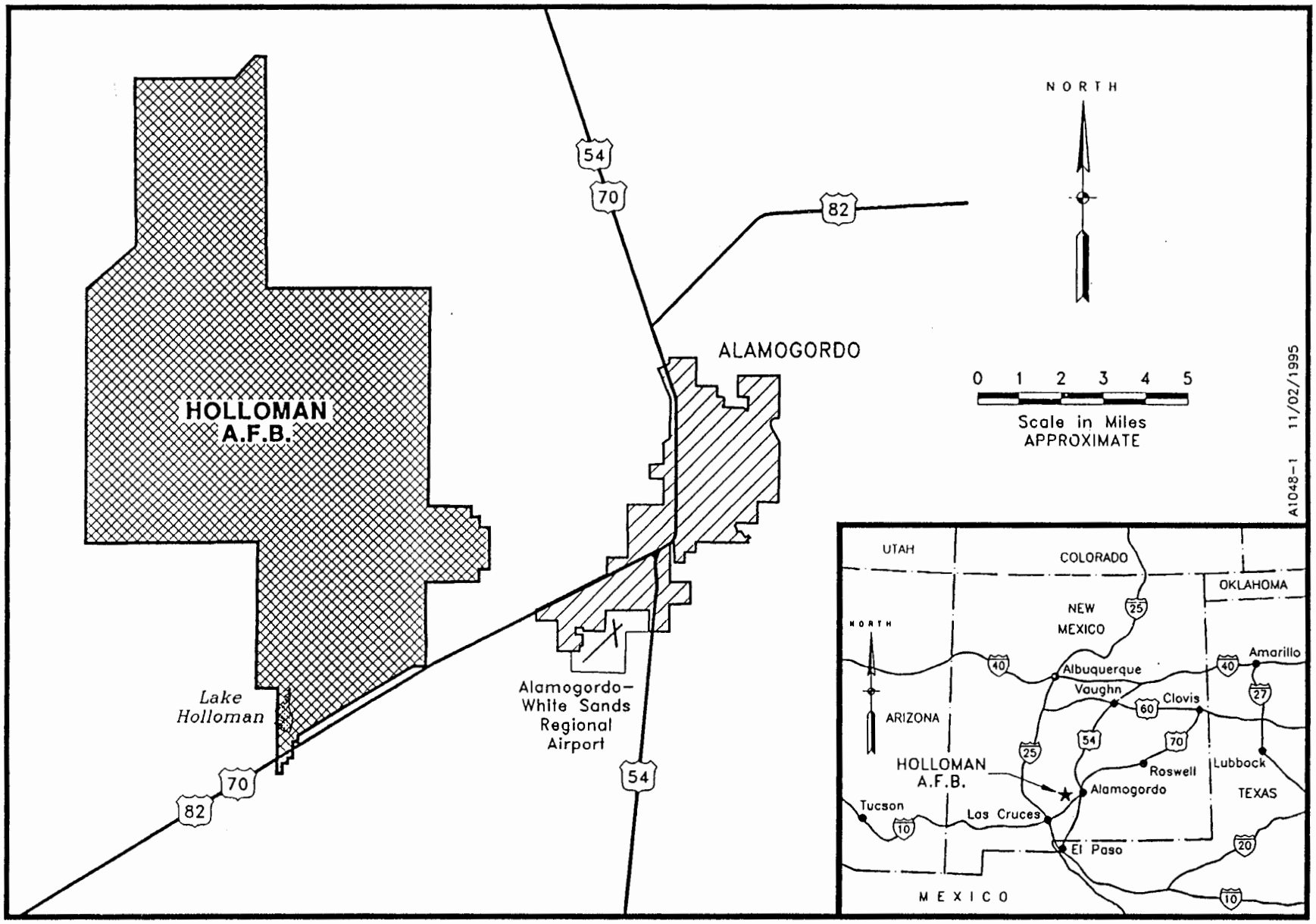


FIGURE G-1: General Location of Holloman Air Force Base

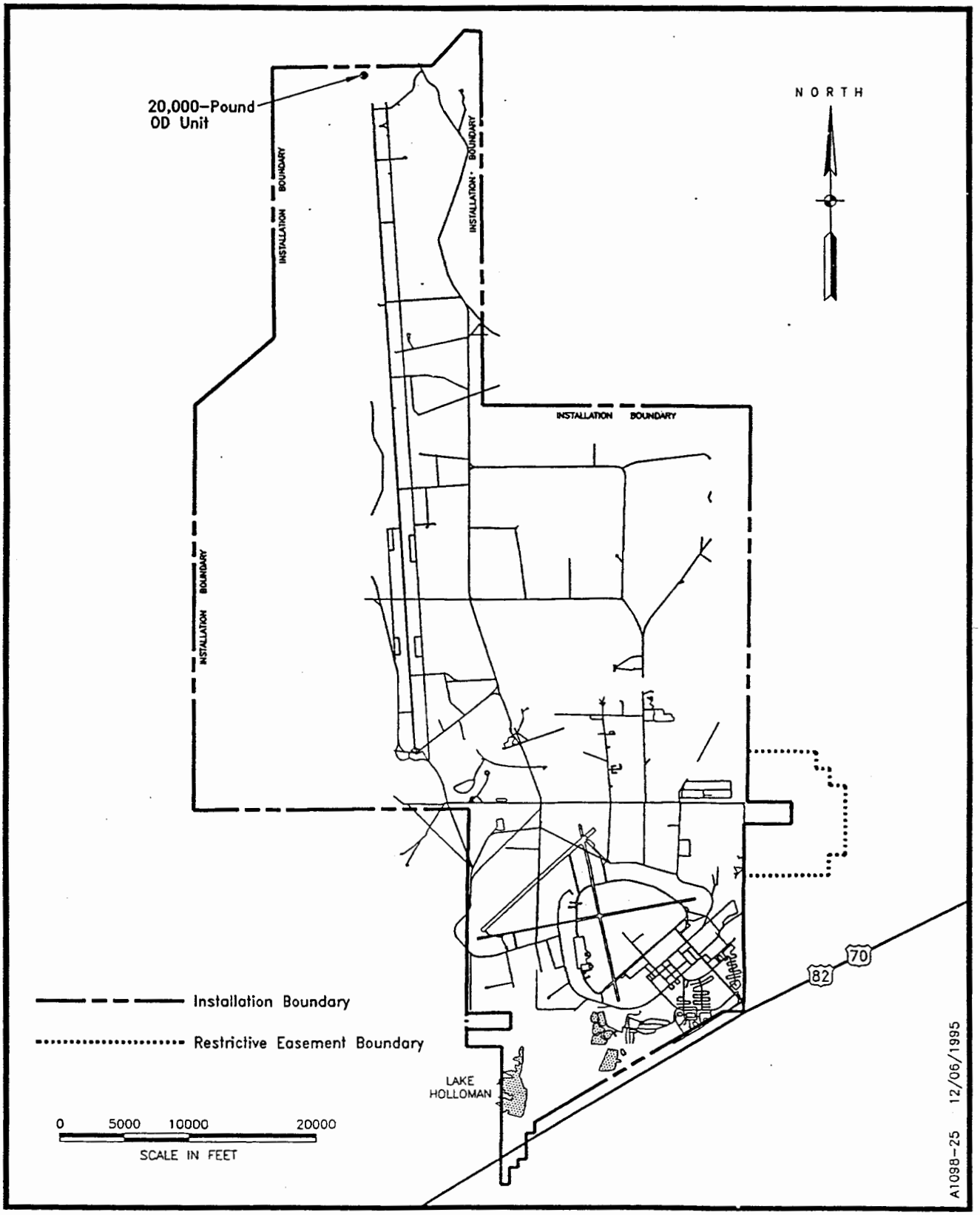


FIGURE G-2: Facility Layout of Holloman Air Force Base.

Currently, HAFB hosts the Air Combat Command (**ACC**) 49th Fighter Wing, which includes pilot training, mobility support, and combat support operations. The primary Air Force Materiel Command (AFMC) component located at HAFB is the 46th Test Group, which is responsible for evaluation of propulsion and navigational systems for aircraft, space vehicles and missiles. A variety of tenant organizations are assigned to HAFB including the 4th Space Warning Squadron, the New Mexico State University Primate Research Laboratory, and Detachment 4, the 50th Weather Squadron. A general layout of the facility is provided in Figure G-2.

As a result of ACC readiness requirements and the 46th Test Group activities, a variety of ordnance, munitions, incendiaries, and propellants become waste because of exceedence of shelf-life, unanticipated deterioration, or failure to attain specifications that render the device non-serviceable. These waste explosives are considered characteristically hazardous under the Resource Conservation and Recovery Act (RCRA) due to reactivity (D003). Rocket motors that exceed 300 lbs are treated at the 20,000-Pound Open Detonation Unit that is the subject of this permit. These units are regulated under 40 CFR 264, Subpart V §264.600.

The 20,000-Pound OD Unit derives its name from the relevant operating procedures for this treatment activity. The net explosive weight (NEW) of solid propellant rocket motors that are, and will be simultaneously treated in the trench is limited to 20,000 lbs (i.e., 20,000 lbs per treatment event). This total does not include the mass of the casings, other associated containment devices, and detonating charges. Although the precise number of treatment occurrences during any year is variable, discrete treatment events will occur at typical frequencies of at least one event per month, giving a total of 450,000 pounds NEW per calendar year. More specific information on ordnance constituents, the OD Unit, and operating procedures is provided in future sections.

The 20,000-Pound OD Unit consists of a clear zone approximately 400 feet in diameter. Treatment of the wastes is accomplished by placing the explosive ordnance on top of the ground within a 100-ft diameter area at the center of the clear zone. The waste is then treated by detonation. The force of the explosion often creates a depression in the ground, which is inspected to ensure that the waste has been completely destroyed. Unexploded ordnance (UXO) that may have been ejected from the depression is collected and returned to the depression and exploded again to treat the UXO. Casings and fragments that do not have UXO are collected and containerized. Subsequent detonations are performed at

locations surrounding the first depression within the 100-ft diameter detonation area. When the detonation area is covered with depressions, a bulldozer smooths out the site, filling in the depressions. During quarterly soil sampling, the last detonation depression is not filled in, nor is any dirtwork conducted, until the soil samples have been collected. The location of the OD Unit and its surrounding area relative to the main base is provided in Figure G-3 and G-4. A unit drawing of the area, showing dimensions of the unit, is shown in Figure G-5.

TOPOGRAPHIC MAP

The general requirements are met in a topographic map of the 20,000-Pound OD Unit and the surrounding area in Figure G-3. The provided topographic map indicates that the unit is located in relatively flat terrain; the OD Unit is also above the 100 year floodplain boundaries. No surface water of constant flow conditions is located in the area, although arroyos that contain runoff are located in the vicinity of the unit.

The topographic map delineates the area relief at intervals of 10 feet. Figure G-3 shows a large and small scale topographic map of the Unit. The large scale map is at a scale of one inch equal to 300 ft and shows topography in a 3000 by 2500-ft area around the Unit. The map is presented at that scale because all topographic contours are visible and a larger portion of the area surrounding the Unit can be seen. The small scale map shows the topography of the surrounding area and all hydrologic features in the vicinity of the unit. HAFB facility boundaries are designated in both Figures G-3 and G-4.

SURROUNDING LAND USE PATTERNS

The 20,000-Pound OD Unit is located approximately 1000 ft within the northern boundary of HAFB. White Sands Missile Range lies to the north and west of the adjacent base boundaries. All lands within HAFB boundaries are under the control of the U.S. Air Force. Thus, the unit is surrounded by access-controlled Federal lands for a distance of several miles in all directions. The unit is situated on undeveloped grassland near areas of barren land (dunes) and arroyos and is isolated from commercial and residential land uses. The closest building on or off the Facility is approximately 4000 ft from the OD Unit. Figure G-3 show the distances to the nearest residential buildings (72,700 ft), public roadway (48,000 ft), and passenger railroad (85 miles). Figure G-4 shows the land use immediately surrounding the OD Uni, and Figure G-5 shows the OD unit.

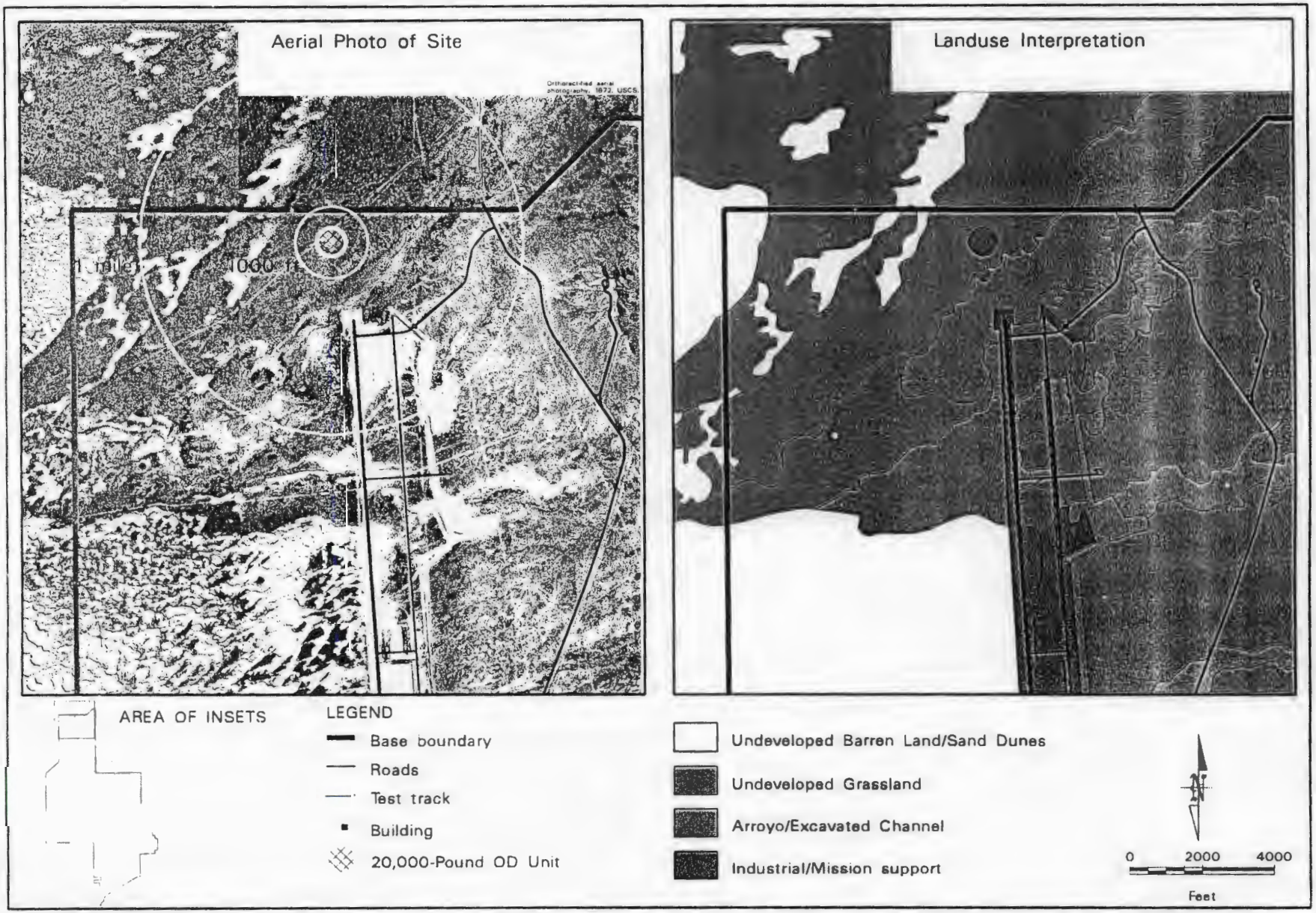
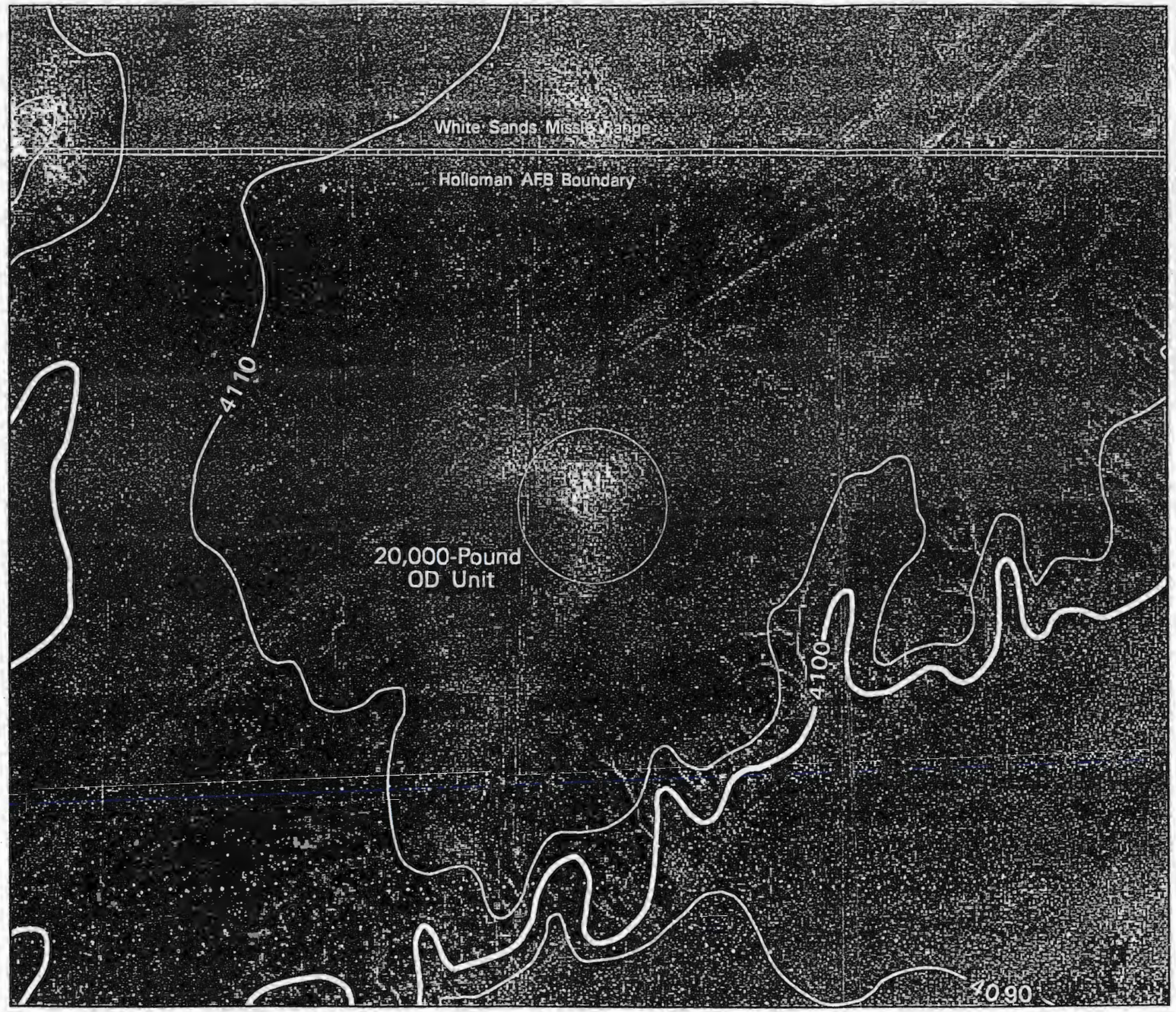
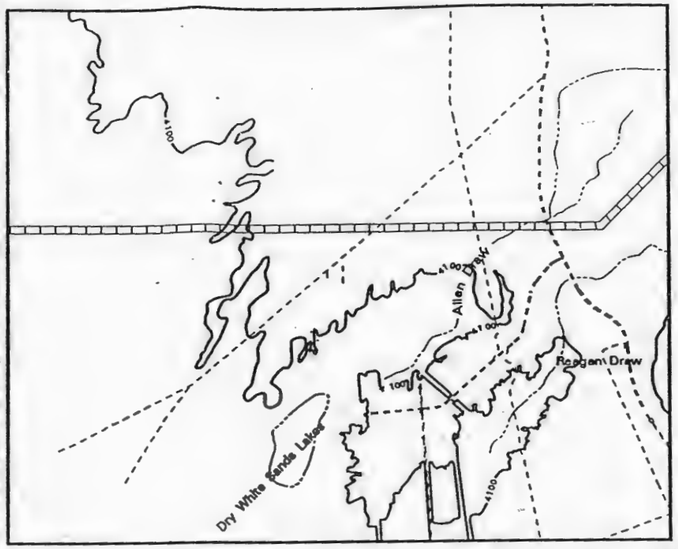


FIGURE G-3: Location of the 20,000-Pound OD Unit and Surrounding Landuse.



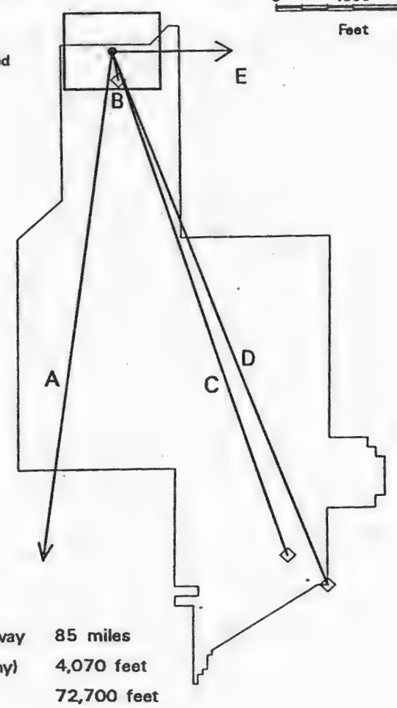
Source: U.S. Geological Survey, 1981. Tularosa Peak, NM 7.5-minute quadrangle.
Photo: Orthorectified Aerial Photo, U.S.C.S., 1972.

0 200 400
Feet



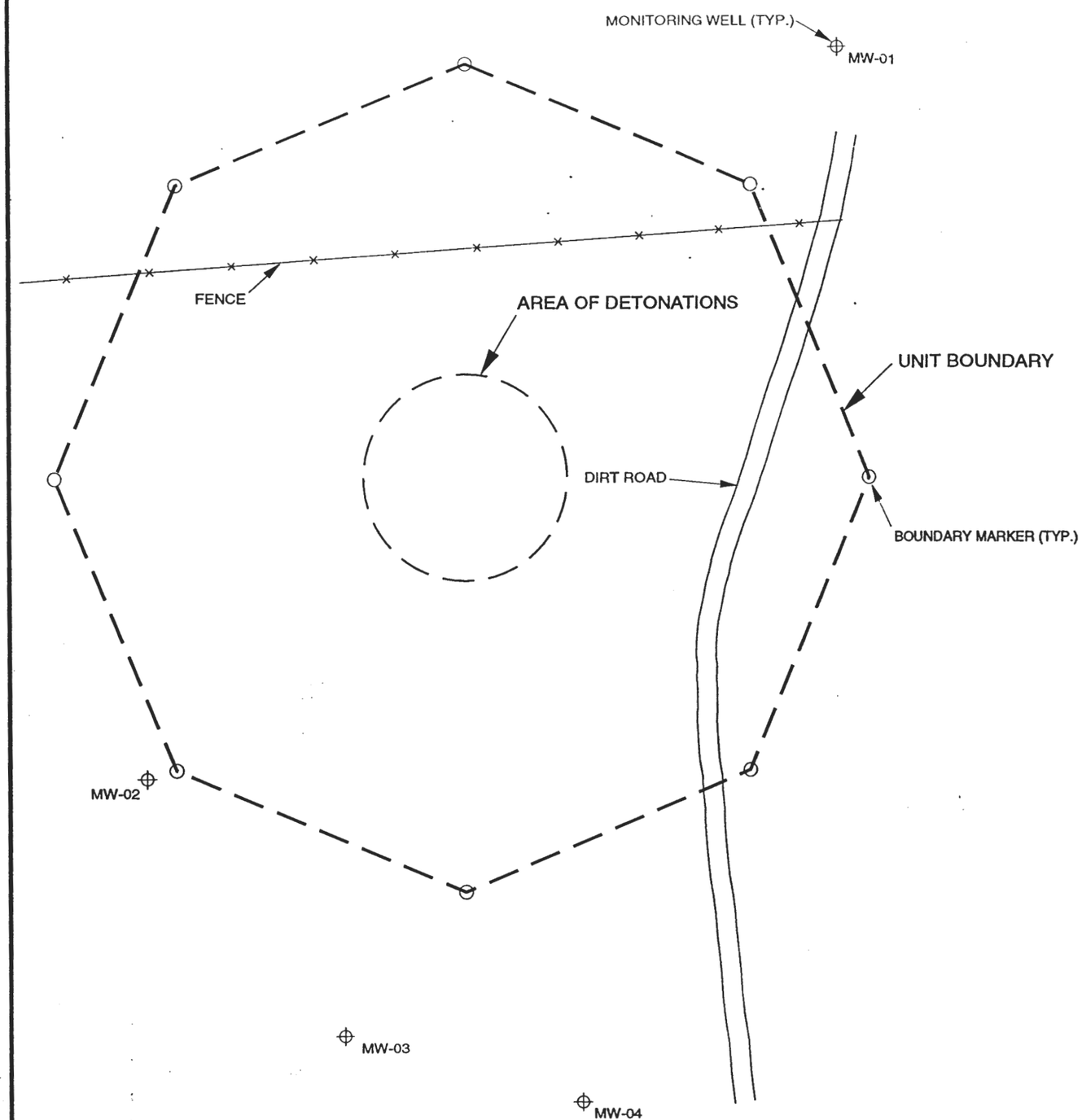
0 1500 3000
Feet

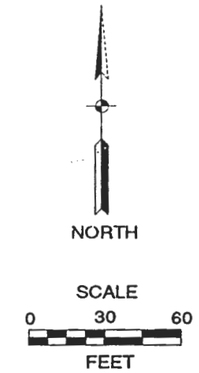
Topographic contour
Road
Intermittent stream bed
(Contour Interval = 10 ft)



A	Nearest Public Railway	85 miles
B	Nearest Building (any)	4,070 feet
C	Nearest Building (residential)	72,700 feet
D	Nearest Public Roadway (accessible)	78,500 feet
E	Nearest Public Roadway (inaccessible)	48,000 feet

FIGURE G-4: Topographic Map of the 20,000-Pound OD Unit





DESIGNATION	NORTH	EAST	ELEVATION
MW-01	415406.8	552694.5	4114.13
MW-02	415054.0	552355.4	4115.93
MW-03	414929.6	552451.3	4113.28
MW-04	414897.0	552568.1	4112.79

NOTES:

1) THE COORDINATE SYSTEM USED FOR THIS SURVEY IS THE WHITE SANDS TRANSVERSE MERCATOR SYSTEM (WSTM), ELEVATIONS ARE NAD 1929. INFORMATION WAS PROVIDED BY THE TEST TRACK GEODESIST AND THE DEFENSE MAPPING AGENCY.

2) ELEVATIONS ARE TO NOTCH POINT IN PVC PIPE.

MODIFIED FROM BURKE & ASSOCIATES, P.C., ALAMOGORDO, N.M., JOB NO. 951031, 12/19/95

DATE: 1/31/96	RADIAN CORPORATION
DRAWN BY: SLC	
REVIEWED BY: GDH	20,000 LB. OPEN DETONATION UNIT
SCALE: AS SHOWN	
DWG. NO. D2252A	HOLLOMAN AFB NEW MEXICO

FIGURE G-5: Detailed Drawing of the 20,000-Pound Open Detonation Trench

METEOROLOGICAL CHARACTERISTICS

Estimated Annual Precipitation

The annual precipitation at Holloman AFB averages 7.9 inches, with annual extremes from 2.5 inches to 13.5 inches. The mean annual lake evaporation rate, commonly used to estimate the mean annual evapotranspiration rate, averages an estimated 67 inches per year. The annual net precipitation for the area is approximately -59 inches per year.

Diurnal Temperature Variation

The mean daily temperature variation in the Holloman OD treatment unit area ranges from an average daily low of 26° F in December to an average daily high of 93° F in July. Pertinent meteorological data are also provided below in Table G-1. Wind roses for the five most recent years are provided in Appendix G.

GEOLOGY

Holloman AFB is located within the northern Chihuahuan Desert, in the region known as the Tularosa Basin. The basin is approximately 120 miles long and 28 miles wide. It is bounded on the east by the Sacramento Mountains and on the west by the San Andres Mountains. The basin was formed when the surrounding mountains were uplifted, creating an elongated, faulted valley known as a graben. Elevations within the Tularosa Basin range from 4400 feet above mean sea level (MSL) at the northeast corner to 4000 feet MSL in the southwest corner. The OD Unit is located down slope of the Sacramento Mountains at an approximate elevation of 4100 feet MSL.

The surrounding Sacramento and San Andres Mountains are composed of Precambrian to Permian granite, limestone, dolomite, and gypsum with interbedded clays, sands, and gravels. Eroded sediments from these mountains were deposited by streams, filling the Tularosa Basin. Since these sediments were carried by water into a closed basin they are called bolson deposits. These bolson deposits are approximately 4,000 feet thick in the vicinity of Holloman AFB. Only the uppermost bolson deposits are of significance to this permit text. A generalized geologic cross-section of the present-day Tularosa Basin is presented in Figure G-6.

TABLE G-1

Meteorological Data for Holloman AFB[a]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average or Extreme
Temperature (°F)													
Monthly mean	41	46	52	61	69	81	79	73	62	49	49	42	61
Mean daily high	58	60	66	76	84	93	91	86	76	63	63	55	75
Mean daily low	28	31	37	43	54	68	66	60	48	35	35	26	47
record high	78	80	90	94	109	108	106	102	92	82	82	75	109
Record low	-11	0	9	23	26	52	54	38	26	3	3	2	-14
Precipitation (in)													
Monthly mean	0.5	0.4	0.3	0.2	0.4	0.7	1.2	1.3	1.2	0.9	0.3	0.5	7.9
Record maximum	1.9	1.4	3.0	0.8	2.9	3.6	3.7	4.4	3.5	4.2	2.5	2.4	4.4
Record minimum	0	T[b]	0	0	0	T	T	0.2	T	0	0	0	0
Relative humidity (%)													
4 a.m. mean	66	61	52	40	42	62	60	66	68	61	61	63	57
1 p.m. mean	42	35	27	19	24	19	31	35	38	34	34	37	31
Surface wind													
Mean velocity (knots)	4	4	6	7	4	6	5	5	4	4	4	4	5
Prevailing direction	N	N	S	S	S	S	S	S	S	S	S	S	S

[a] Source: Radian, 1992.

[b] T = trace.

Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

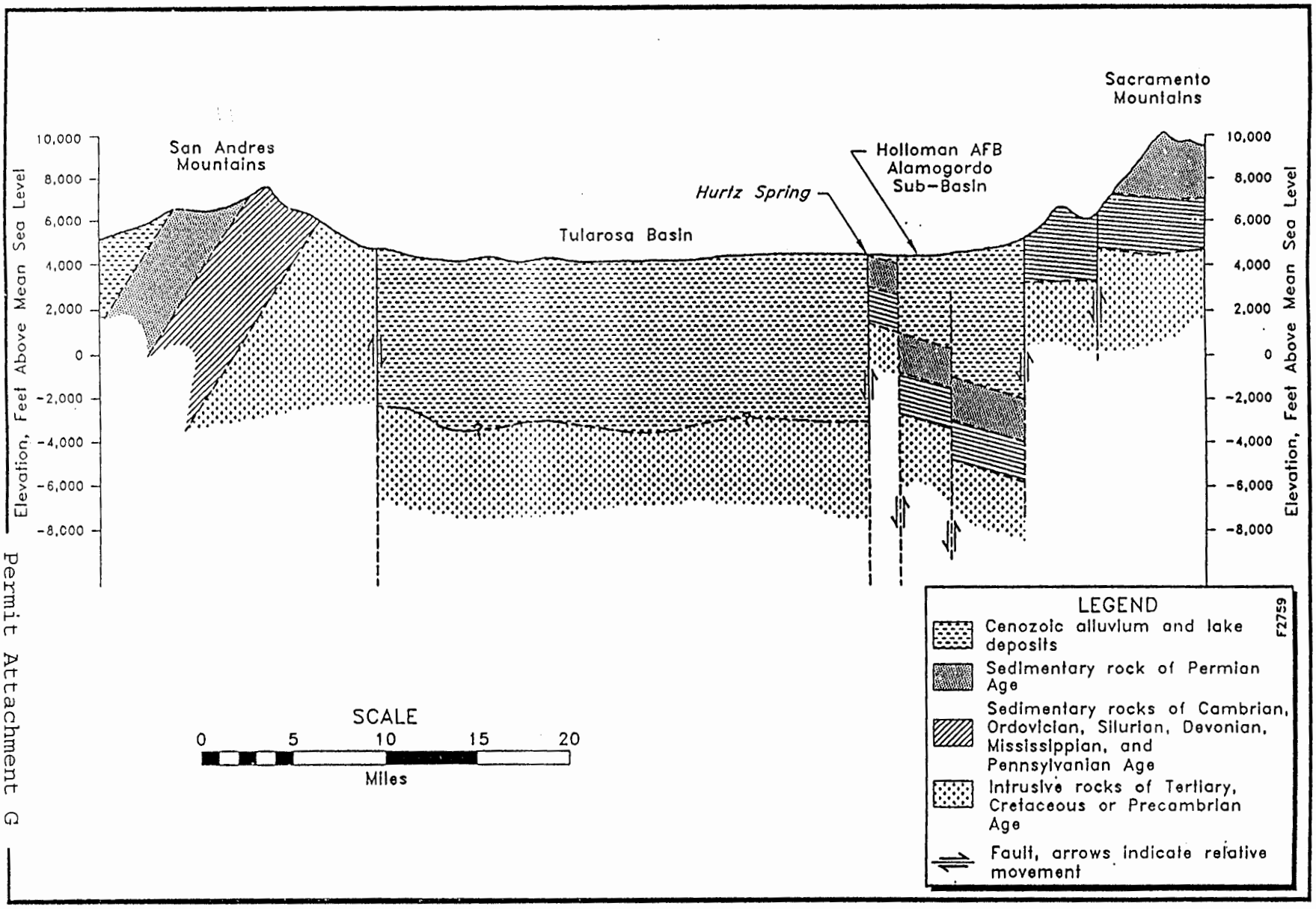


FIGURE G-6: Generalized Geologic Cross Section of the Tularosa Basin

Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

SOILS

Subsurface soils were investigated in 1993 during installation of four monitoring wells discussed in Permit Attachment K (HAFB/EOD-MW01, 02, 03, and 04) near the OD Unit. A detailed description of the OD area soils is presented in Permit Attachment K. Lithologies encountered during the investigation are presented in a generalized geologic log (Table G-2) and illustrated in a geologic cross-section of the OD Unit (Figure G-7).

An analysis of the geologic cross-section presented in Figure G-7 shows a slight change in depositional environments across the OD Unit. The thickest sequence of silty clay (playa-lacustrine deposits) is shown in HAFB/EOD-MW01, while HAFB/EOD-MW-02 shows the thickest sequence of sand and silty sand mixtures (eolian deposits). The eolian deposits are predominantly interdune deposits consisting of fine sand and silt. Below 30 feet the geologic interpretation becomes more complex. The geologic logs show lithologic changes across the site between silty clay, silty sand, and sand at the downgradient wells (HAFB/EOD-MW-02, 03, and 04). Meanwhile, the upgradient well (HAFB/EOD-MW01) shows massive silty clay with stringers or lenses of sand. It is highly probable that these sand zones are interconnected.

SURFACE WATERS

Surface water flows in the vicinity of HAFB are generally intermittent in nature. The topographic map that was provided in Figure G-3 shows the surface water features in the area. The boundaries for the 100-year and 500-year floodplains are not near the unit.

FLOOD CONTROL/DRAINAGE BARRIERS

No structures for the control of flooding or drainage are present at the 20,000-Pound OD Unit. The unit is elevated sufficiently above the floodplain elevations that flooding potential is considered virtually nonexistent.

TRAFFIC INFORMATION

Access to the 20,000-Pound OD Unit is provided by a single paved road. A dirt road provides access from the paved road to the edge of the OD Unit. The detonation area is approximately one quarter mile from the paved road.

Traffic along this route is restricted to official use by the EOD personnel during explosive operations, but may be accessed by

TABLE G-2
Generalized Geologic (Soil Boring) Log[1]

Depth	Generalized Description
0 and 10 feet	**SAND** - Light tan, yellowish tan and light brown fine grained well sorted sand with layers of silt-sand, porous, loose to slightly firm and dry to trace moisture present. This upper zone represents eolian type deposits. The sands are most likely dunes and the silt-sand represent an interdune sequence.
10 to 12 feet (Extends to 16 feet at HAFB/EOD-MW02)	**SILT to SILTY CLAY** - Reddish brown (HAFB/EOD-MW02 also had alternating layers of gray green and light gray to white), slightly firm, low to moderately plastic and dry to trace moisture. Most likely represents a small playa at the site [2,3]
12 to 30 feet (Extends to 40 feet at HAFB/EOD-MW02)	**SAND** - Light tan, yellowish tan and light brown with reddish brown and brown layers, predominantly a fine grained, well sorted sand and with occasional layers of medium to coarse grained sands slightly firm to firm and trace moisture present.
30 to 50 (HAFB/EOD-MW02 starts at 40 feet)	**SILTY CLAY with interbedded SAND** - A gradational change of depositional environments can be observed in the logs. Reddish brown silty clay representing playa/lacustrine deposits[2] with dune and interdunal deposits merge in and out of the clay, or back and forth across the playa. The occasional thin layers of sand in the larger clay units may represent wind blown particulate across the playa or an occasional sheet flood that are common in this type of environment. The clay deposits are thickest at HAFB/EOD-MW01. These deposits are reddish brown silty clay with light gray or green gray mottling[4] in the upper 2 feet, moderate to high plasticity, slightly firm to firm, ranging in moisture from trace to wet. At 50 feet, 1 to 2 mm gypsum crystals were found. Sands found below 30 feet are fine to medium grained, medium grain predominant. At HAFB/EOD-MW02 flowing sands were encountered at 42 feet.

[1] Modified from ICF Kaiser and Labat-Anderson, 1993.

[2] The reddish brown color associated with the playas are common and suggest an oxidizing environment of the iron present in the sediments. The coloration may also imply well drained soils.

[3] Poorly drained soils which are saturated most of the time are generally gray in color, because the iron has been reduced or removed. This is true for humid climates, however, not always true in arid environments.

[4] A mottled gray and reddish brown color suggests the subsoils are subjected to alternating or seasonal periods of saturation.

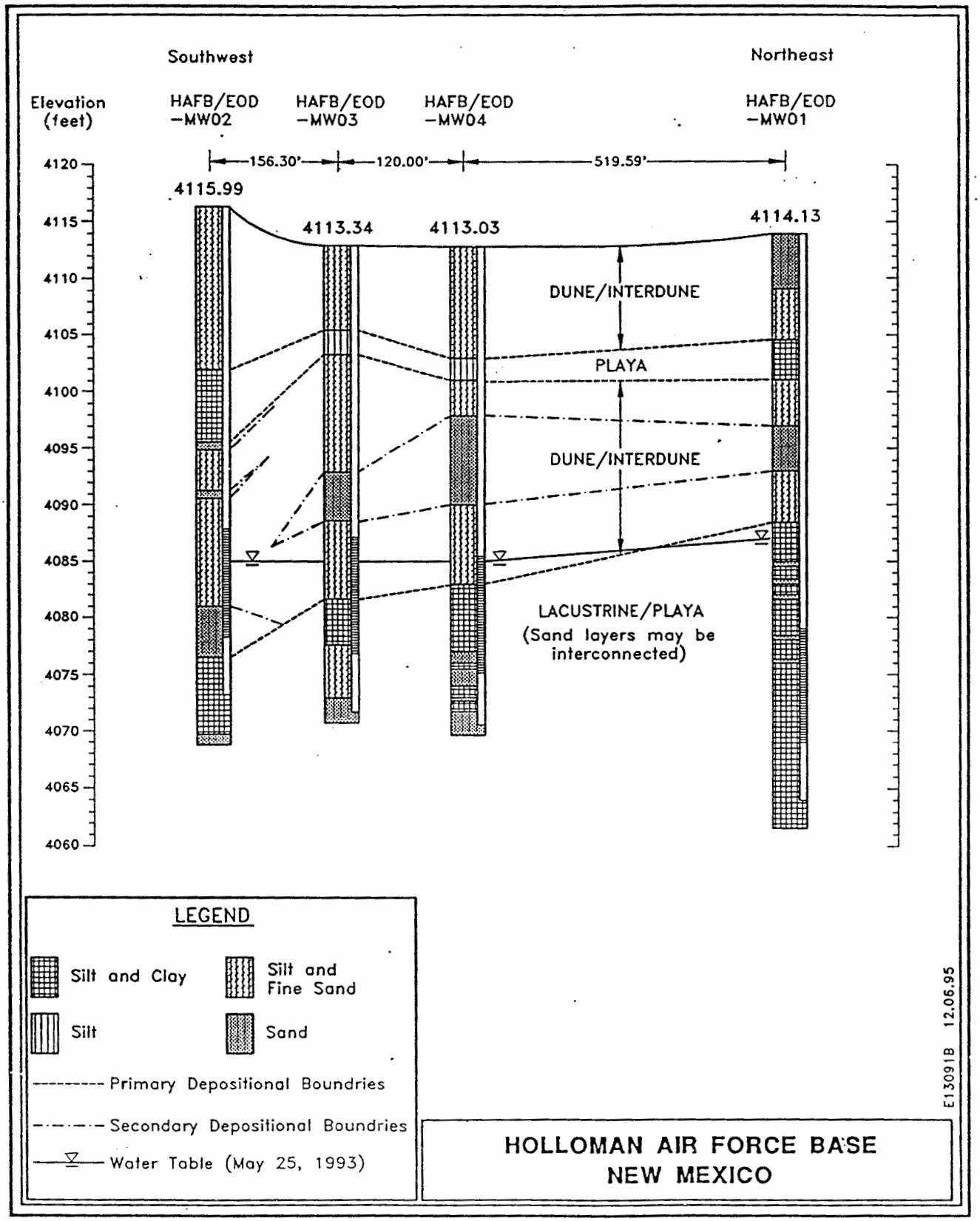


FIGURE G-7: Geologic Cross Section of the OD Unit Area (after Labat-Anderson, 1993)

Test Track personnel who are needed during operations. As a result of these restrictions, the typical traffic volume and pattern consist of a maximum of several vehicles per day that are in transit to or from the unit.

ACCESS ROAD SURFACE AND ITS LOAD BEARING CAPACITY

The only access road to the subject OD treatment unit is a paved surface. This surface is periodically maintained to prevent formation of holes, ditches, or other deformation that would increase the possibility of accidental detonation during transport.

The paved service road was graded and compacted to provide capacity for automobiles, light trucks, heavy trucks, and service vehicles. The maximum amount of waste moved per vehicle movement along the paved surface road is 40,000 pounds. This total weight includes not only the net explosive weight but weight from inert casings, canisters, etc.

THREATENED AND ENDANGERED SPECIES

There are no domestic animals or crops in the area around the /OD Treatment Unit. Although several endangered species (i.e., *Aplomado Falcon, American Peregrine Falcon, Penasco Least Chipmunk*) and threatened species (e.g., *Common Black Hawk, Meadow Jumping Mouse, and White Sands Pupfish*) occur in Otero County, there are no endangered species near the OD Treatment Unit.

The primary vegetation around the OD unit is native sagebrush and chaparral bush. The basal area of these bushes may become singed or burned in the immediate vicinity of the OD unit as a result of OD activities. In the event of this happening, the EOD personnel conducting the operations will extinguish the fires using the portable fire extinguishers described in Permit Attachment E, Contingency Plan.

RUN-ON AND RUN-OFF CONTROL

An earthen berm 2 feet high will be constructed on the east and south sides of the OD unit to complement the natural berms that exist on the north and west sides of the pit. This berm will serve to prevent run-on from precipitation to the OD unit, and run-off of hazardous constituents from the OD unit.

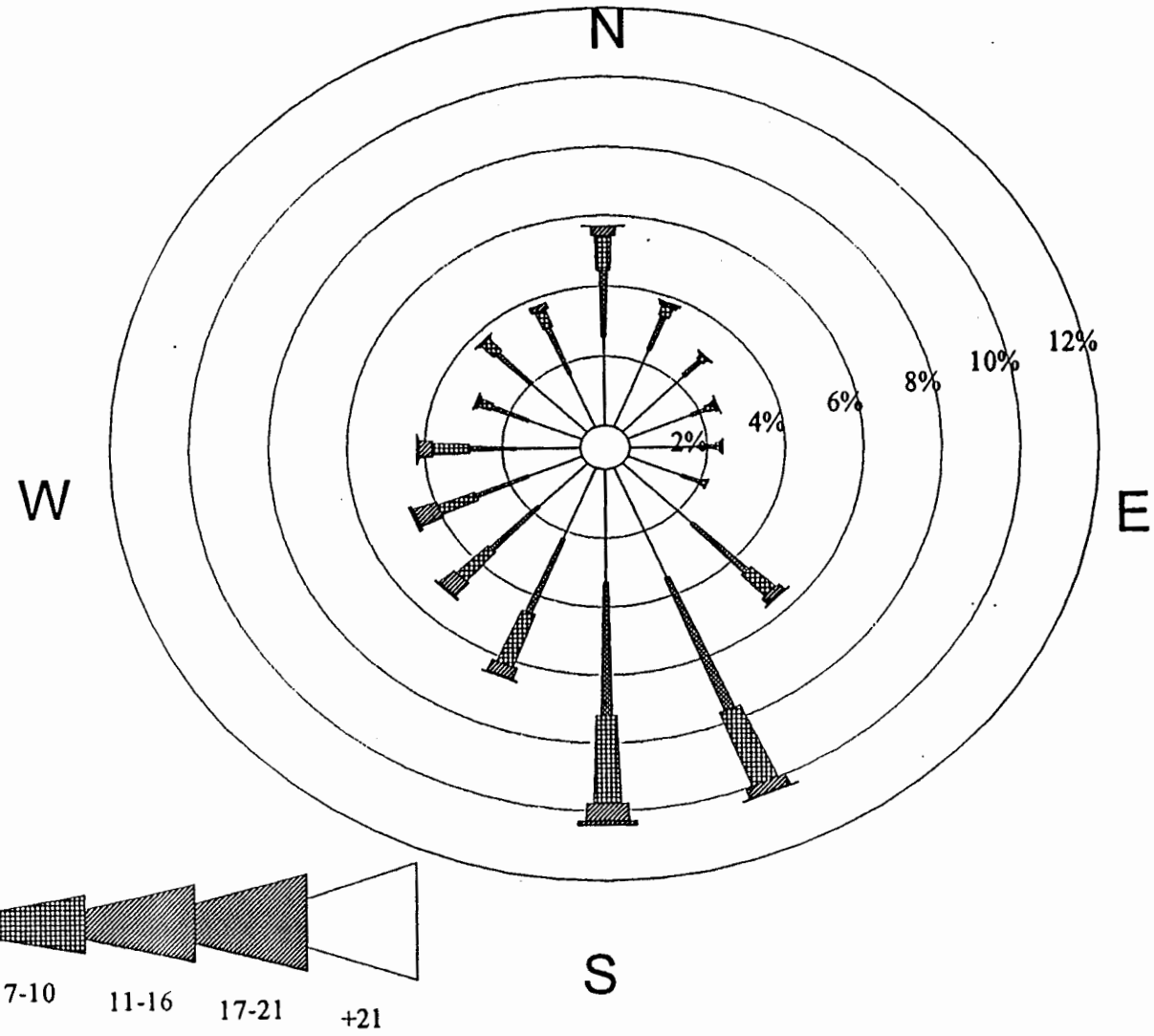
ARCHEOLOGICAL SITES

There are no archeological sites near the HAFB OD Treatment Unit.

APPENDIX G

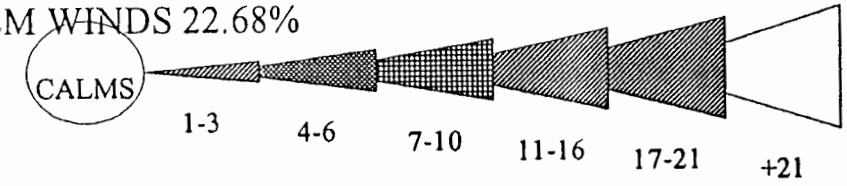
WIND ROSES FOR HAFB OPEN DETONATION TREATMENT UNIT FOR FIVE RECENT YEARS: 1990-1994

Holloman AFB 1990
January 1
December 31
Midnight-11 PM



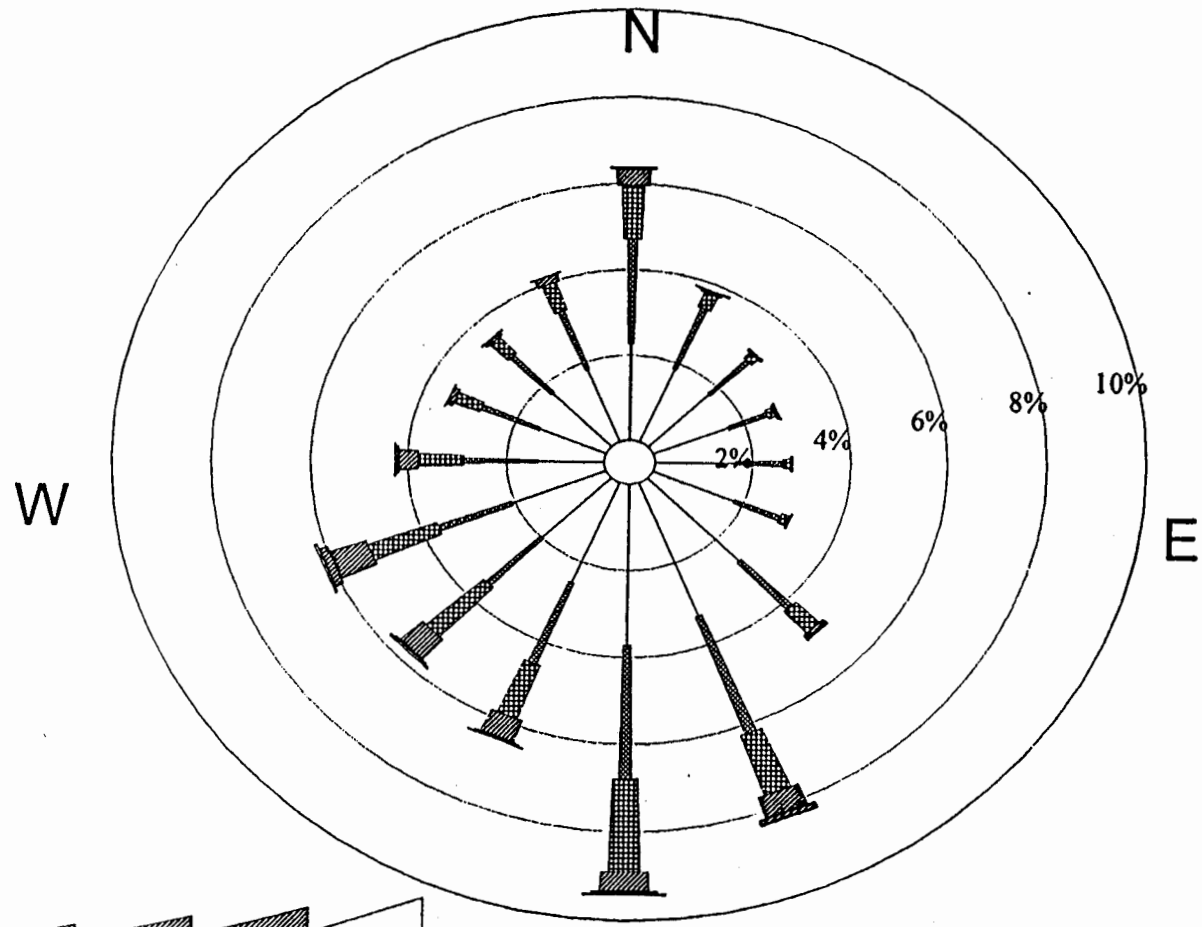
NOTE: Frequencies indicate direction from which the wind is blowing.

CALM WINDS 22.68%



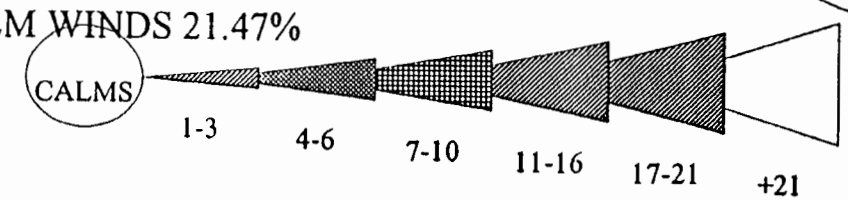
Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

Holloman AFB 1991
January 1
December 31
Midnight-11 PM



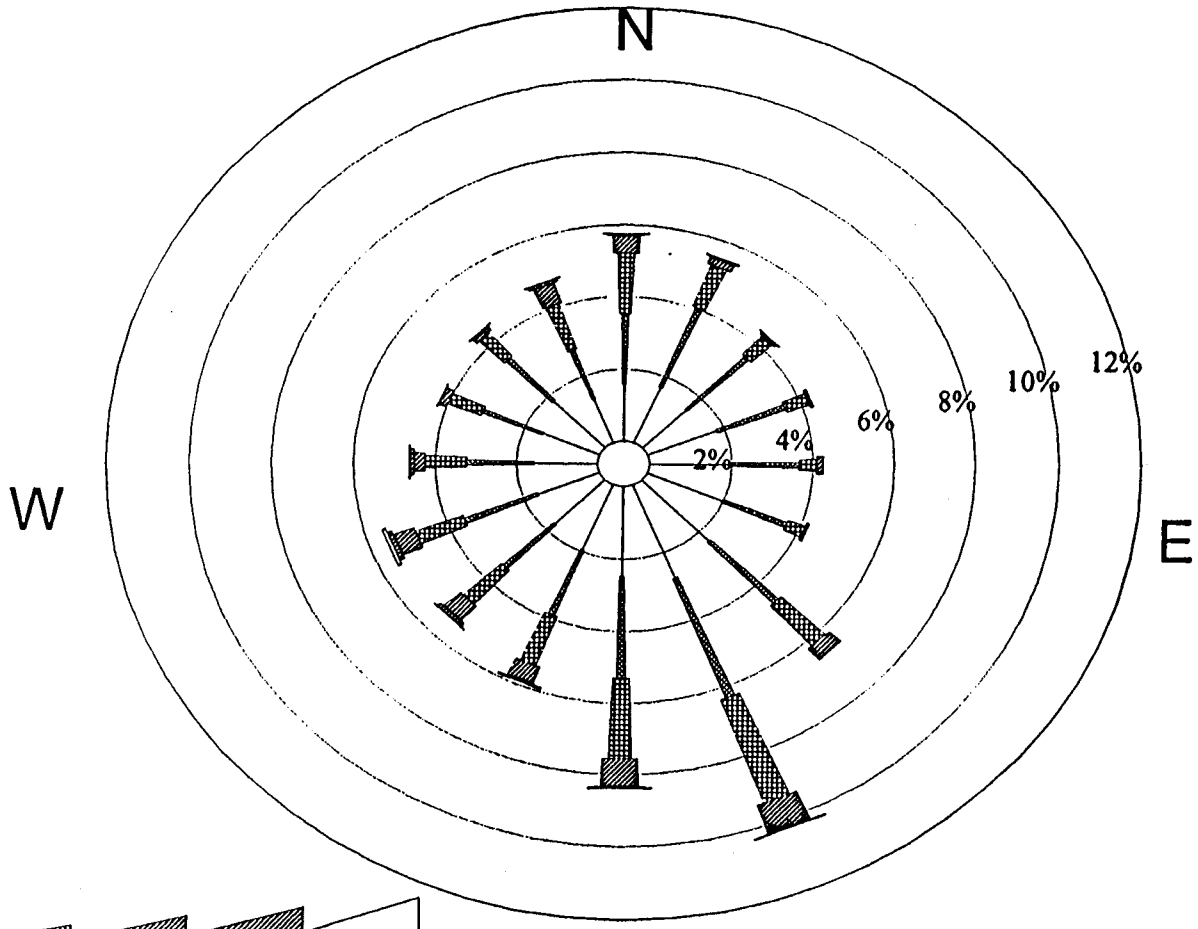
NOTE: Frequencies indicate direction from which the wind is blowing.

CALM WINDS 21.47%



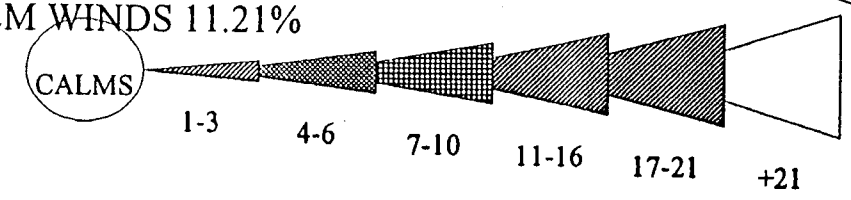
Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

Holloman AFB 1992
January 1
December 31
Midnight-11 PM



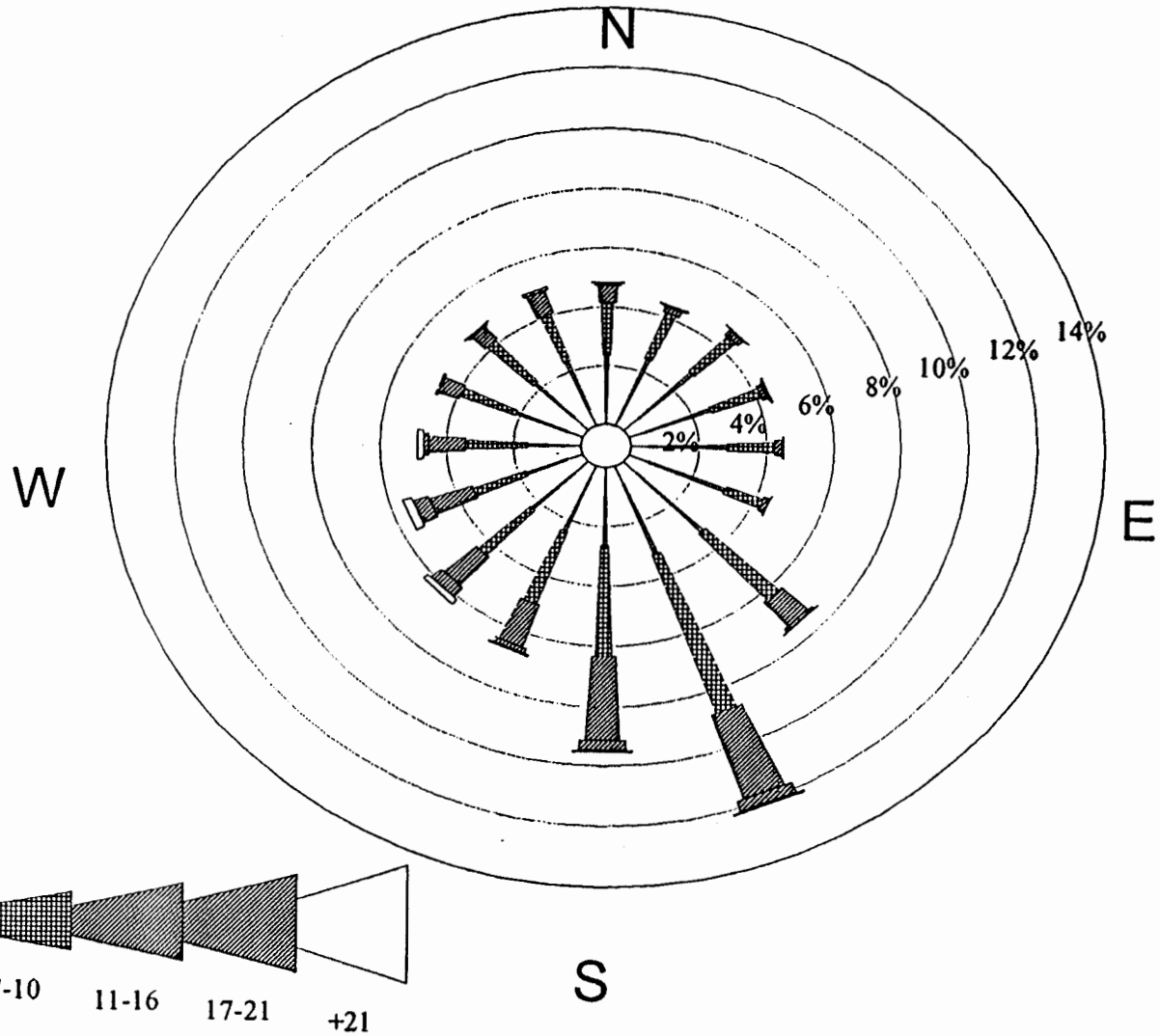
NOTE: Frequencies indicate direction from which the wind is blowing.

CALM WINDS 11.21%



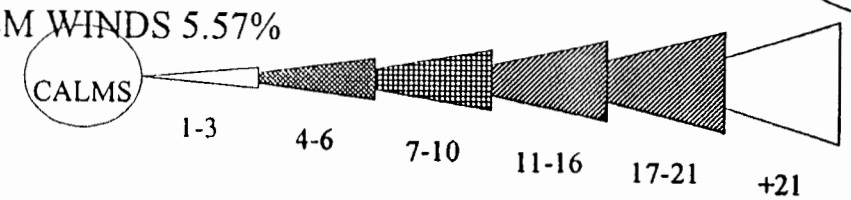
Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

Holloman AFB 1993
January 1
December 31
Midnight-11 PM



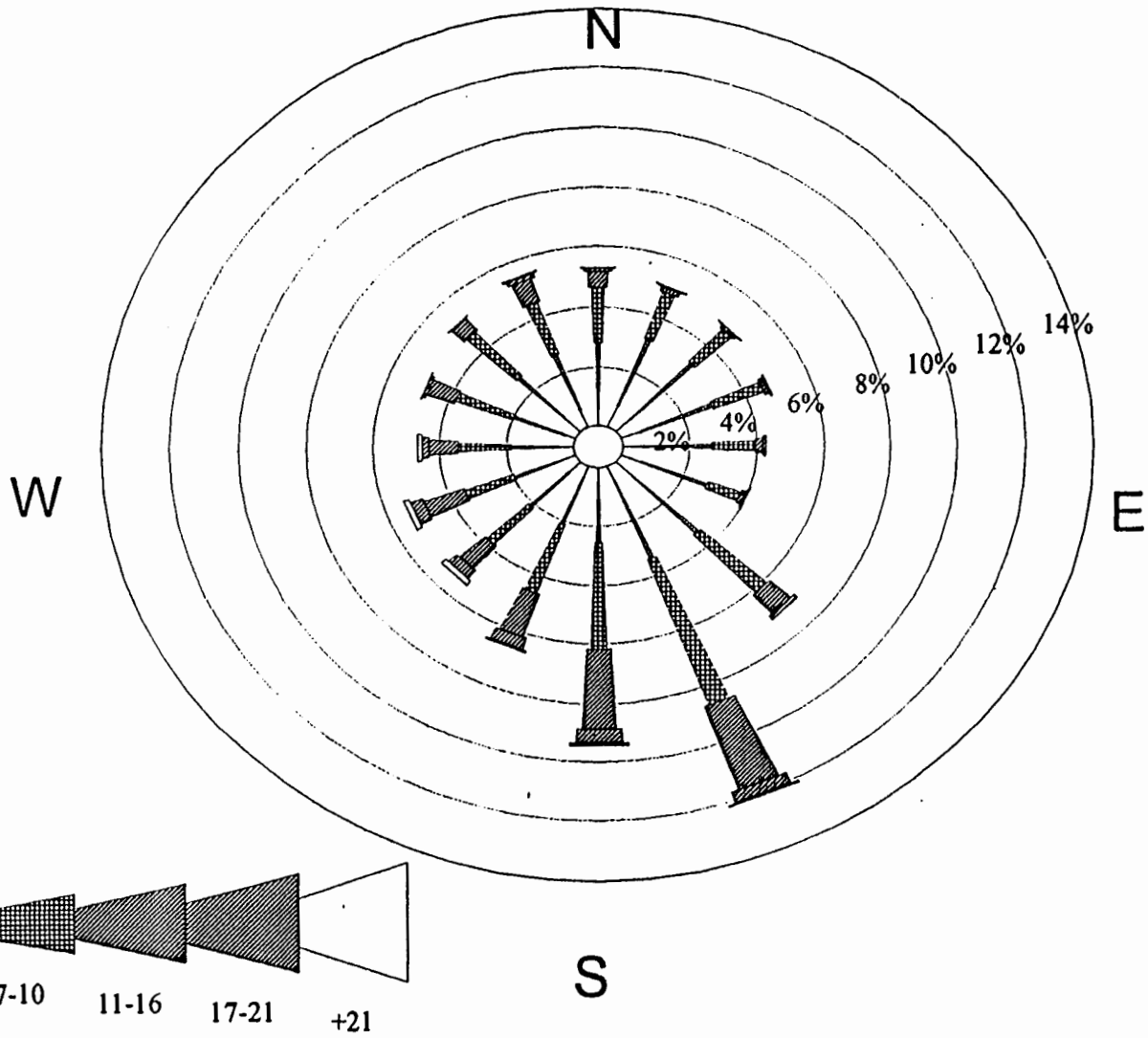
NOTE: Frequencies indicate direction from which the wind is blowing.

CALM WINDS 5.57%



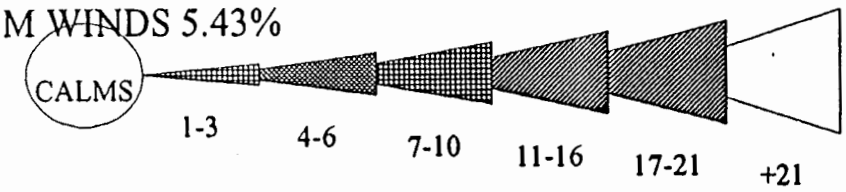
Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

Holloman AFB 1994
January 1
December 31
Midnight-11 PM



NOTE: Frequencies indicate direction from which the wind is blowing.

CALM WINDS 5.43%



Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

PERMIT ATTACHMENT H

PROCEDURES FOR HANDLING IGNITABLE, REACTIVE OR INCOMPATIBLE WASTE

Introduction

Holloman Air Force Base provided the following information to the New Mexico Environment Department (**NMED**), Hazardous and Radioactive Materials Bureau (**HRMB**), in compliance with the requirements of New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V, 40 CFR §264.17.

LOADING/UNLOADING OPERATIONS

Procedures to prevent incidental detonation of the waste are also applicable to spill prevention during pretreatment operations. Explosive Ordnance Disposal (EOD) procedures to prevent accidental detonation are detailed in the U.S. Air Force Publications: *TO 11A-1-42 and TO 11A-1-60*. In general, these procedures specify use of nonsparking tools, encasement to reduce impact, use of certain clothing materials, and, most importantly, removal of primers and initial detonators from the device. The explosive nature of the waste indicates the greater hazard to be incidental detonation during transfer of waste into the detonation zone. None of the energetic waste contains free liquid.

All vehicles will be inspected before loading. Deficiencies will be corrected at the time of inspection, if such correction is considered necessary for safe delivery to the unloading point. During loading or unloading of vehicles, the brakes must be set and if the vehicle is on a grade, at least one wheel must be chocked.

No explosives or ammunition will be loaded into or unloaded from vehicles while the motor is running unless the motor is required to provide power to vehicle accessories, such as mechanical handling equipment utilized in the loading and unloading of the vehicle.

Handling and Preserving Explosives:

a. Improper, rough, and careless handling of explosives may result in undue accidents which could result in loss of life, injury or property damage. The history of accidents which have occurred in the use, handling, shipping, and storing of ammunition shows that in many instances where the

cause was determined, the accidents have been due to human error and circumstances which were avoidable.

b. If hazardous conditions present immediate danger to life and property, operations will not be continued until the hazard has been removed.

c. Explosives and ammunition will be handled and transported carefully. Containers will not be tumbled, dragged, thrown, dropped on each other, rolled, walked over or dropped from tailboards of trucks.

d. Explosive containers should not be opened unnecessarily and should remain sealed until needed.

Procedures to ensure safe handling of these reactive waste are detailed in TOs 11A-1-42 and 11A-1-60. All operations are performed by fully-trained EOD personnel under the direction of the EOD Supervisor. These personnel are familiar with procedures to be followed for the material being handled.

PRECAUTIONS TO PREVENT IGNITION OR REACTION OF IGNITABLE OR REACTIVE WASTE

Each waste item that is destined for treatment at the OD unit will be handled in accordance with TOs 11A-1-42 and 11A-1-60. Waste energetic items will not be opened at any time due to the potential for accidental detonation. Post-detonation residues will be inspected to ensure no untreated waste remains in the OD treatment unit. Further details about waste handling at the OD unit are contained in the Standard Operating Procedures, Permit Attachment I.

PERMIT ATTACHMENT I

STANDARD OPERATING PROCEDURES

Introduction

The following information was provided in accordance with the requirements of New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V, 40 CFR §264.17 and §264.601. The Standard Operating Procedures (**SOP**) define uniform standard procedures, instructions and safety precautions to be employed during Explosive Ordnance Disposal (**EOD**) operations conducted at the Holloman Air Force Base (**HAFB**) 20,000-pound open detonation treatment unit. These standards ensure that HAFB will implement the OD activities in a manner protective of human health and the environment.

TRANSPORTATION OF EXPLOSIVE WASTE TO THE OD UNIT

The waste energetic items are transported in accordance with TO 11A-1-60 and other relevant orders. Prior to transport, the EOD supervisor briefs all members of the team on hazards associated with specific items, pertinent technical data, technical orders, specified treatment procedures, safety precautions, and transport procedures.

These waste munitions are transported to the OD Unit in their original containers or casings, which are designed for long-term stability and thus ensure that no wastes are inadvertently released to the environment prior to treatment. In addition, no free liquids are included among the wastes treated at the OD Unit. Free liquids in waste have a much higher potential of infiltrating into the soil and migrating vertically.

TREATMENT PROCESS

The 20,000-Pound OD Unit provides thermal treatment to waste propellant devices identified as hazardous waste due to reactivity. Certain constituents that may be present in these wastes could potentially pose a risk to those exposed to them. In order to render the wastes nonreactive and eliminate this risk, they are thermally treated. Once the wastes have been successfully treated, they are no longer considered hazardous. Thermal treatment is accomplished by placing the waste within the aboveground cleared OD unit and detonating it.

All OD Unit waste treatment activities are conducted on the

ground surface. No trenches or pits are excavated to contain the wastes. Detonation charges that consist of RDX explosives are added to the waste pile in order to detonate the wastes. The OD operations are conducted within a single graded area at the OD Unit (approximately 400 feet in diameter), as described in Permit Attachment G. Potential contaminants which may be released during thermal treatment are generally limited to trace amounts of explosive compounds or metals. The thermal treatment process generally ensures complete destruction of the wastes. After a detonation, any unexploded fragments of the original ordnance are collected and re-exploded to further ensure that complete destruction of the original waste ordnance has occurred. Larger metallic fragments are picked up after each detonation for proper disposal. Because the wastes are treated on the ground surface, a thorough collection of the waste fragments and unexploded ordnance is possible.

OPERATING PRACTICES

Operational procedures at the 20,000-Pound OD Unit are governed by Department of the *Air Force Publication TO 11A-1-42* and *Holloman AFB Regulation 136-2*. These orders specify certain atmospheric conditions for OD treatment operations. In summary, these conditions are:

- **temperature**: general (>55°F); winter (not specified);
- **wind speed:** general (4 to 15 miles per hour); winter (7 to 15 miles per hour;
- **precipitation:** no treatments allowed;
- **cloud cover:** none or limited; and
- **time:** 7:00 am to 5:00 pm (daily).

The climatic conditions at Holloman AFB generally allow detonations to be conducted under conditions specified as "excellent" in *TO 11A-1-42*.

Personnel who perform operations at the 20,000-Pound OD Unit are specifically EOD-trained staff members. The total number of EOD personnel is limited to those required to perform the operation.

A minimum of two personnel, one of which is an EOD supervisor, are required for all operations. These personnel are provided

both initial training at the Indian Head Proving Ground, Maryland school for ordnance and also receive annual reviews concerning ordnance items and Resource Conservation and Recovery Act (**RCRA**) requirements. Permit Attachment D outlines the required training.

During all operations, the EOD supervisor operates as the range manager and controls initiation of the thermal treatment. Prior to initiation of the treatment event, all other EOD personnel are required to move and take cover south of the 20,000-Pound OD Unit outside the danger area.

Several efforts are performed prior to the thermal treatment event. All waste energetic items destined for treatment are inspected, logged, and accounted for prior to removal from stock or other designation as waste. It should be noted that these items become waste primarily through shelf-life exceedance or inequalities noted during inspections of serviceable items. A complete inventory of items to be treated is compiled on the advance disposal request which requires headquarters approval before treatment can proceed. Additionally, an inventory of items to be treated is recorded on the EOD Report (AF Form 3579). Prior to the scheduled treatment event, the EOD supervisor notifies the following base agencies:

- meteorological service (for imminent weather conditions);
- munitions control;
- base medical service;
- security police;
- base operations;
- the on-site coordinator; and
- base environmental coordinator.

Upon arrival at the unit, all waste energetic items are inspected and accounted for by comparison with the previously prepared inventory. During transport and operations, all nearby roads are cleared, posted, and maintained free of traffic.

To limit the potential for incidental detonations, all removal primer and detonating items are removed from the waste energetic items. No attempt is made to remove these items if they are integral parts of the device.

EXPLOSIVE OPEN DETONATION TREATMENT

The actual treatment is accomplished by placement of the waste

items on the ground within the OD Unit and attachment of C-4 (RDX) donor charges to the waste item. An "explosive train" is constructed and remote control detonation is initiated from the designated clear zone. The donor device consists of a series of components that are referred to as an explosive train once the individual devices are placed in combination. An explosive train consists of a primer, an initial detonating agent, and a high explosive. Explosive train detonation is achieved by step-wise detonation of the components.

STANDARD OPERATING PROCEDURES

Two Weeks Prior to Scheduled Detonation:

1. EOD chief selects EOD team. EOD chief conducts a briefing with the team, which includes the following topics: hazards involved, treatment procedures, pertinent technical orders to reference, safety precautions, and transport procedures.

2. EOD team conducts a range inspection in accordance with permit requirements. Specific problems inspected for include free-standing liquids, unexploded munitions, vegetation, burrowing, signs of runon/runoff, and debris. The EOD team also inspects the road leading to the OD unit to identify holes, ditches, or settling that could cause problems during the transportation of the munitions.

3. EOD team checks all items listed for treatment to identify proper disposal techniques, and calculates the total mass being detonated. The team ensures that the total mass does not exceed 20,000 pounds net explosive waste (**NEW**) per event, and also calculates net explosive weight.

4. EOD team notifies the flight munitions custodian of explosive requirements, to ensure that explosives will be on hand prior to the scheduled operation.

5. EOD team ensures that all inspections of emergency response equipment, safety equipment, security devices, EOD vehicles, and operating equipment are up-to-date and that no problems exist.

ONE WEEK PRIOR TO THE SCHEDULED OPERATION

1. EOD team chief checks and verifies items to be treated, and checks calculations regarding amount of explosive to be used

and net explosive weight.

2. EOD team chief checks with munitions to make sure explosives will be on hand for treatment event.

ONE DAY PRIOR TO THE SCHEDULED OPERATION

1. EOD chief conducts briefing with team on the pending operation, and makes team assignments.

2. EOD team contacts munitions to draw explosive materials.

3. EOD team contacts munitions storage personnel to ensure delivery time will be met.

4. EOD team draws and inspects all necessary equipment to ensure operability.

5. EOD team notifies base fire department, medical services, security police, base operations staff, and base environmental coordinator of pending operation.

6. EOD team contacts base meteorology team to get a forecast of predicted weather conditions for the following day, and to notify them of the operation.

TIMING OF OD OPERATIONS

1. Not more than 20,000 net explosive waste shall be disposed of during any OD event.

2. Open Detonation activities will only be conducted between the hours of 7: am and 5:00 pm, from Monday through Sunday.

3. All OD activities will cease when there is a thunderstorm within 10 miles of the OD Treatment Unit.

4. Open detonation of explosive waste munitions will not be conducted during a duststorm.

5. Open detonation will not be conducted during a snowstorm.

6. Open detonation will not be conducted during a sandstorm.

DAY OF THE SCHEDULED OPERATION

1. EOD team contacts base meteorology team to ensure that all weather conditions meet permit terms, including wind speed

and direction, temperature, stability, and precipitation.

2. EOD chief conducts safety briefing with all team members, as well as highlights transportation of explosives requirements and procedures.

3. EOD chief provides arms to personnel who will be transporting explosives. Conducts a briefing on the use of firearms.

4. EOD chief ensures that radio communication lines are kept open with the EOD team during the drawing and transportation of explosive materials.

5. EOD team proceeds to munitions storage. EOD chief supervises the munitions loading operations.

6. EOD team transports munitions and explosives to OD unit.

7. EOD team conducts a final inspection of the OD unit.

8. EOD chief makes radio contact with the test track control and the EOD operations center. He ensures mobile two-way radios are placed in appropriate locations (with team members, track control net, team chief, and safety observer).

9. EOD team conducts a physical inspection of all munitions brought for treatment. Compares inventory listing with letter of disposal request to ensure all items are accounted for. Only items identified on the letter of request can be treated; all others will be refused and returned to munitions storage for reschedule. EOD chief will monitor and identify and deficiencies and refuse treatment if discovered.

10. Once inventory is completed, EOD team places items in the area for treatment.

11. EOD chief segregates initiation explosives and prepares firing set-up.

12. EOD team sets up dual-primed firing systems to initiate the main charge.

13. The EOD chief checks firing systems in primed positions.

14. The EOD team and EOD chief withdraw to safe area.

15. The EOD chief obtains approval for detonation from the

Holloman tower via test track control.

16. Waste is detonated by remote control.

17. Once detonation is evident, EOD chief makes long range reconnaissance of the surrounding area to determine the presence of possible kick-outs and/or fires.

18. The EOD chief dispatches two EOD team members to inspect the shot. Once the site is determined clear, remaining EOD team members can return to the detonation area. The OD unit is inspected to determine that the munitions were completely destroyed.

POST OPERATION PROCEDURES:

1. Within 24 hours of the operation, the EOD chief will sign all required expenditure documentation, and place a copy in the project folder. A copy of the EOD report will be prepared, including an inventory listing and a list of personnel participating. The report will include the net explosive weight amount and the facility used.

2. EOD team cleans and inspects all EOD vehicles and other equipment.

3. If necessary, EOD chief makes arrangements to have depressions in the OD unit backfilled.

PERMIT ATTACHMENT J

SAMPLING AND ANALYSIS PLAN

Introduction

The following information on the methodology of sampling and analysis of soil disturbed by open detonation (**OD**) activities at the Holloman Air Force base (**HAFB**) 20,000-pound OD unit, was provided to the New Mexico Environment Department (**NMED**) by HAFB in accordance with the requirements of 20 NMAC 4.1, Subpart V, §264.13(b).

This Sampling and Analysis Plan (**SAP**) provides procedures for the required environmental sampling at the 20,000-Pound (**lb**) OD Unit which will be used to treat waste explosives. Environmental sampling is necessary for HAFB to demonstrate that the OD Unit is being operated in a such a manner that residual waste constituents are not contaminating soils above risk-based cleanup levels and/or background levels. This SAP contains sampling and analysis protocols for the following three distinct phases of environmental sampling at the subject OD Unit:

1. Background sampling to establish site-specific background constituent concentrations;

2. Routine, or operations sampling to test the soils at the OD Unit for the effectiveness of the treatment process and to ascertain whether any contamination has impacted ambient soils;

3. Closure sampling to be completed in the event that HAFB terminates operations at the OD Unit.

Technical Approach

This SAP design is based on U.S. Air Force (**USAF**) OD operational procedures, knowledge of the waste munitions characteristics, and the environmental conditions at HAFB. In addition, the procedures and quality assurance/quality control (**QA/QC**) techniques in U.S. Environmental Protection Agency's (EPA's) November 1986 *Test Methods for Evaluating Solid Waste* have been used to prepare this SAP.

Background Sampling

Prior to any routine monitoring, one round of six background soil samples will be collected at a distance of between 500 feet and 1000 feet from the OD Unit boundary. These samples will serve to characterize conditions of soil similar to the OD Unit but unaffected by past OD activities.

For operations monitoring purposes, soil at the OD Unit will be sampled quarterly using a stratified random sampling approach. Discrete samples of near surface soil will be collected from random locations within each strata from a depth of about 6 inches, and analyzed for explosive and metal constituents. There will be no compositing of samples. Analytical results will be compared to background results and calculated risk-based concentrations to determine whether operations at the OD Unit are affecting soils at the site.

In the event that HAFB terminates operations of the OD Unit, a final round of sampling will be completed. Closure sampling and analysis will use the same decision criteria as operations sampling and will also incorporate previous sampling results.

Data Quality Objectives

Data quality objectives (**DQOs**) are statements that define the type, quantity, and quality of data necessary to address a problem before a study begins. The EPA has published a seven-step process to DQO development as guidance (U.S. EPA, 1993). These seven steps have been designed to allow owners/operators of treatment, storage, and disposal facilities to define their data requirements and acceptable levels of decision errors during planning, before the data is collected. Following the DQO process ultimately leads to a more efficient data collection design. Table J.1-1 describes each of the seven steps as will be applied by HAFB to conduct monitoring of contaminant constituents at the OD Unit.

Table J-1

Data Quality Objectives

Step 1.	**State the Problem to Be Resolved** Residuals from detonation events may be present at levels greater than background or risk-based concentrations (RBCs).
Step 2.	**Identify the Decision** Determine whether constituents exist at levels greater than background or RBCs.
Step 3.	**Identify the Inputs to the Decision** Chemical analyses for explosive residues, metal constituents, and nitroglycerin using U.S. EPA methods SW-846 8330 and 6010 (except for Mercury by 7471), and 8332 respectively. Risk based concentrations (RBCs) and background constituent concentrations are action levels.
Step 4.	**Define the Boundaries of the Study** The OD Unit, divided into three distinct populations, or strata. Strata definitions are based on the volume of detonation ejecta received and the natural boundaries of the site.
Step 5.	**Develop a Decision Rule** A. If concentrations in any of the strata are statistically different than background concentrations or RBCs, further evaluation will occur. Further evaluation may include additional sampling, site-specific risk assessment, or remediation. B. If average concentrations in Stratum C are significantly different than background concentrations or RBCs, the boundaries of the study will be revised to include a Stratum D.
Step 6.	**Specify the Acceptable Uncertainty Limits** The uncertainty in the average concentration of a stratum is targeted to be plus or minus 100% of the average concentration and is achievable with four samples per strata. The uncertainty in comparing strata averages to the background average is a minimum detectable relative difference of 120% with an alpha error of 20%.
Step 7.	**Optimize the Design for Obtaining the Data** Collect four discrete samples from each of the strata. Samples will be randomly selected from a pre-determined grid. Within each stratum, sampling depth will vary based on the estimated thickness of impacted soil.

Organization of this Sampling and Analysis Plan (SAP)

This SAP has been organized to address each of the data quality objectives in Table J-1, in a manner that is useful for soil sampling at the OD Unit. The following sections contain physical descriptions of the site and background geologic information. In addition, the three types of sampling, background, operations, and closure, are discussed. Also described are sample handling and chain of custody (**COC**), documentation activities, laboratory analysis, and data evaluation methods.

SITE DESCRIPTION

The physical descriptions of the OD Unit, location and the environmental conditions, including geology, hydrogeology, topographic and drainage features, and climate at HAFB, is described in Permit Attachment G, Facility Description.

BACKGROUND SAMPLING METHODOLOGY

Prior to the first quarterly sampling event, surface soil samples will be collected around the OD Unit to establish background concentrations of metal and explosive constituents to be used in future comparisons. Background samples are intended to be representative of metal and explosive constituent levels in unaffected soils of similar type in the vicinity of the OD Unit. The sample selection procedures and sampling methodology specific to background sampling are provided below.

Sampling Location Selection

Six background samples will be taken at a distance between 500 and 1000 ft from the edge of the OD Unit in soil of similar lithology as within the OD Unit. Samples will not be collected at any location where surface soils appear to be disturbed or near to other contaminant source areas. Figure J-1 shows the location of other sites at HAFB that may potentially contain hazardous constituents. The closest installation restoration program (**IRP**) site, or RCRA solid waste management unit (**SWMU**) is over three miles south of the 20,000-lb OD Unit.

Because visual inspection of the surface soil is necessary in order to obtain a background sample of similar lithology to that of the 20,000-lb OD Unit, the exact sample locations will be determined during sampling. The inset on Figure J-1, however, shows the area from which background samples will be collected and six potential random sampling locations. Samples will be situated as closely as possible to these six locations during the

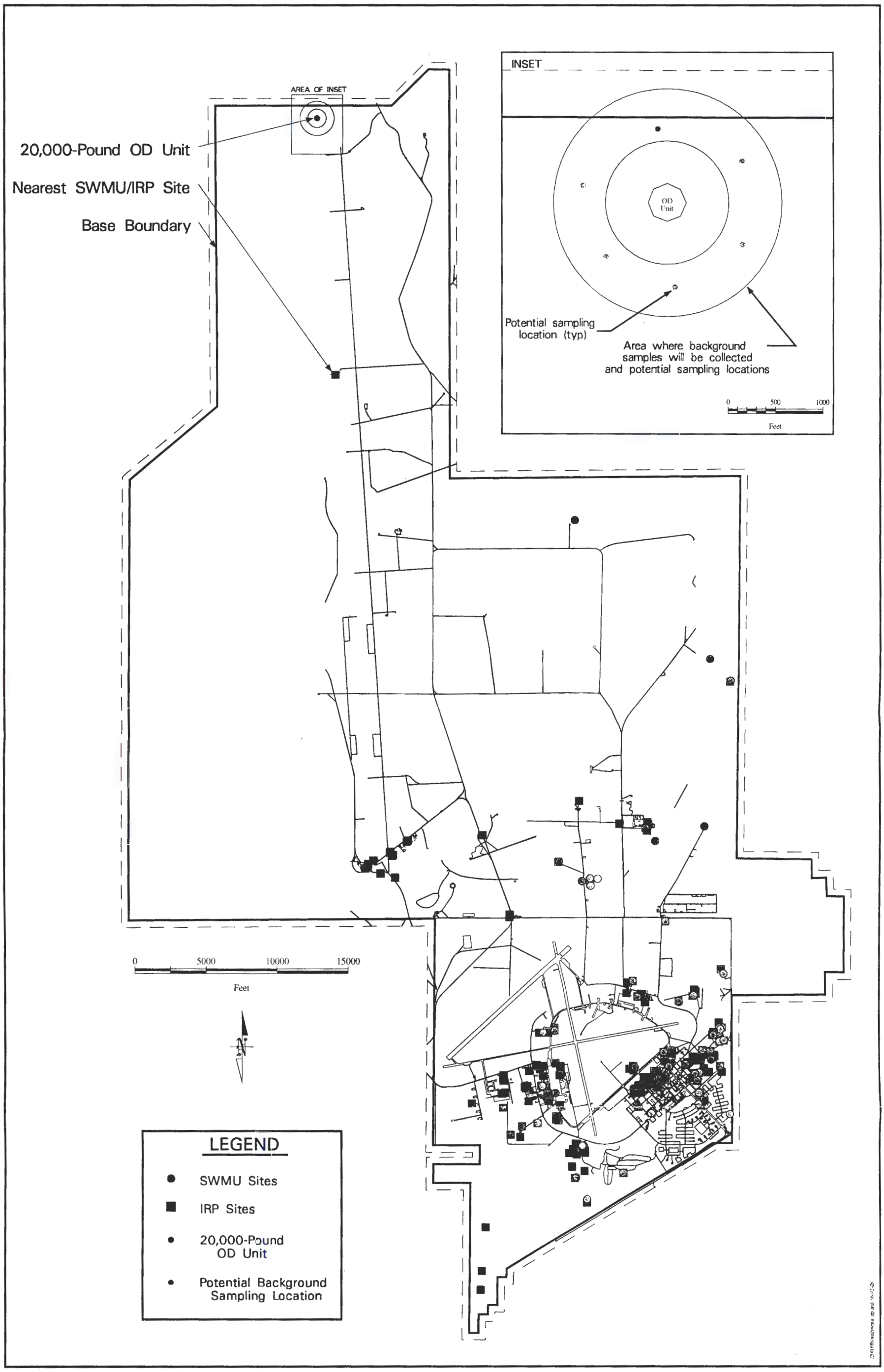


FIGURE J-1 Location of 20,000-Pound OD Unit in Relation to SWMU and IRP Sites at Holloman Air Force Base

background sampling round. Following soil sampling, each location will be marked with a wooden stake and labeled with the background location identification number.

Required Equipment

Required sampling equipment will include a hand-powered soil auger for excavation, containers consisting of 100- to 500-mL glass bottles, plastic caps, a small stainless steel or Teflon-lined trowel, small stainless steel or Teflon-lined spatulas/scoops/spoons, and adhesive labels for sample identification. Sampling procedures will be performed in accordance with American Society for Testing and Materials (**ASTM**) D 1452, "Standard Practice for Soil Investigation and Sampling by Auger Borings," where applicable.

Sampling Methodology

Background samples will be collected by initially advancing the hand auger the length of the bucket (approximately 3 to 6 in.) into the soil. The sample will then be removed from the auger and placed in a stainless steel bowl. The auger will then be inserted back into the hole and advanced. This procedure will be repeated until the auger reaches a depth of 6 inches. At this point, the collected soil will be homogenized in the bowl by mixing, using the spatulas or spoons described above. Appropriate quantities of the soil will be transferred to the sample containers for analysis.

Appropriate sampling information (date, time, sample number, etc.) and observations about the sample location will be recorded in the field logbook. Sampling equipment will be cleaned according to the decontamination procedures described below in a later section of this SAP. Clean sampling equipment will be used at each sampling location.

Chemical Analyses

This section summarizes the analytical procedures that will be followed for site-specific characterization of background constituent concentrations. Soil samples will be analyzed for toxic metals, including priority pollutant metals (listed in the New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V, §264 Appendix IX), explosive residues, and soil moisture. Table J-2 lists all analytes that will be measured along with their EPA SW-846 test methods. The rationale for selecting the analyte list in Table J-2 is the same as that provided in detail in Permit Attachment A, Waste Analysis Plan.

An important consideration for the site-specific background study is the specification of uncensored data for all sampling results. As specified below, the contracted laboratory will be required to report uncensored data. Often, numerical measurement results below a specified concentration are reported with a qualitative descriptor such as "not detected" or "less than" rather than as a numerical value. This practice, called censoring, complicates statistical analyses and data interpretation because an important part of the information about measurement variability is unavailable for consideration. This introduces another source of uncertainty in estimates derived from censored data sets. Uncensored data will be used for this study to preserve all available information in the data about the natural variability of measurements of background concentrations.

Quality Control Samples During Background Sampling

Quality control (**QC**) samples will be collected during the background sampling round to assess the accuracy and precision of the site-specific background results. QC samples will be collected using the same frequency and methodology as described in below.

Table J-2
Analytical Methods for Soil Samples

Parameter/ Constituent	EPA Hazardous Waste Number	Test Method	Reference
Explosive Compounds	D003	8330	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
HMX			
RDX			
1,3,5-Trinitrobenzene (TNB)			
1,3-Dinitrobenzene (DNB)			
Tetryl			
Nitrobenzene(NB)			
2,4-DNT			
2,6-DNT			
2-Am-DNT			
4-Am-DNT			
2-Nitrotoluene (NT)			
3-NT			
4-NT			
Nitroglycerin		8332	
Toxic Metals			Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
Antimony	--	6010	
Arsenic	D004	6010	
Barium	D005	6010	
Beryllium	--	6010	
Cadmium	D006	6010	
Chromium	D007	6010	
Copper	--	6010	
Lead	D008	6010	
Mercury	D009	7471	
Nickel	--	6010	
Selenium	D010	6010	
Silver	D011	6010	
Soil Moisture	--	3550	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).

Because 6 discrete background samples will be taken, one field duplicate and one matrix spike(MS)/matrix spike duplicate (**MSD**) pair will be required. The QC data evaluation will follow the EPA Level III methods described below under the "Laboratory Analysis" section of this SAP.

Statistical Methodology for Calculating Background Concentrations

The approach that will be used for the statistical characterization of background is summarized as follows:

- Evaluate method blanks to characterize laboratory system "noise";
- Evaluate matrix spikes for potential bias in measurements;
- Evaluate background data for outliers and other abnormalities;
- Compare blank results to background results to determine if analytical method sufficient to resolve native concentrations; and
- If native concentrations can be resolved, calculate summary statistics for use in background comparisons (e.g., average, standard deviation, warning limit, upper tolerance limit (**UTL**), etc.); or
- If native concentrations cannot be resolved, report "Background Not Detectable" and determine how this impacts project objectives.

The statistical methodology is explained in more detail in the remainder of this Attachment.

Outlier Testing and Graphical Data Review

After evaluating quality control samples (method blanks to assess laboratory background noise, and matrix spike/matrix spike duplicate samples to evaluate potential biases in the data), the first steps in the statistical data analysis will be to conduct outlier tests to identify anomalous measurement results and to review histograms of the raw measurement data. The fourth-spread outlier test (Hoaglin, Mosteller, and Tukey; 1983) will be used to determine if any individual results are statistically different from the rest of the sample population for both background and blanks. Field and laboratory log books will be

reviewed for each potential outlier to determine whether causes could be identified that would support discarding the outlier from the original data set. Throughout the outlier test process, histograms will be reviewed to confirm that the measurements used in subsequent analyses are reasonable representations of the background and blank populations.

Comparison of Background Results with Blank Results

Background data will then be compared with laboratory blank data to determine if the data sets can be resolved (i.e., background results can be distinguished statistically from analytical background). A statistical test known as the Kolmogorov-Smirnov test [Statistical Analysis of samples (**SAS**), 1989] will be used, together with the graphical data review described above, to assess the comparability of blank and background results for each of analytes of interest.

Normality Testing and Calculation of Summary Statistics

Before upper tolerance limits (**UTLs**) can be calculated the background data set will be evaluated to see if the data appear to be normally distributed. The assumption of normality is a fundamental tenet of statistical tests involving parametric methods. Therefore, the extent to which the data support this assumption determine the direction of the subsequent analyses. A statistical test known as the Shapiro-Wilk test (Shapiro and Wilk, 1965) will be used to test the results for normality.

To summarize the normality testing, tables will be prepared that include the minimum and maximum measured concentrations, as well as estimates of the mean, median, and standard deviation. If results of the Shapiro-Wilk test show that the assumption of normality is not appropriate for some analytes, the summary statistics tables will also include a value for F-pseudosigma, which is a nonparametric measure of dispersion. (The standard deviation is the analogous parametric measure of dispersion.)

Calculation of Warning Limits and UTLs

The results of the Shapiro-Wilk tests will be used to determine whether parametric or nonparametric statistical methods are most appropriate for calculating the warning limits and UTLs. Parametric methods will be used when the population is known or can be assumed to follow a normal distribution. They can also be used when the population of interest can be modeled by some other distribution (such as the log normal) that allows the measurement data to be transformed to a normal distribution. For the

analytes where the Shapiro-Wilk tests did not indicate a significant departure from normality, a parametric UTL for 95% coverage with a 95% confidence will be calculated using EPA methodology (U.S. EPA, 1992). This will represent an upper 95% confidence bound for the 95th percentile concentration. The normal UTL is calculated using the following equation:

$$UTL = \underline{x} + (K \times s)$$

where $\underline{x}$ is the estimated sample mean, **K** is the tolerance factor, and **s** is the estimated standard deviation. The tolerance factor, **K**, can be found in the tabulated form in Tables A.12 of Hahn and Meeker, 1991.

For those cases in which the Shapiro-Wilk tests indicates significant departure from normality, the second step will be to see if a log transformation can be used to produce a more normally distributed data set. Natural logarithms of the results will be taken, and the Shapiro-Wilks test will be repeated on the transformed data set.

If logarithmic transformations do not produce a more normally distributed data set, nonparametric methods will be used to calculate a UTL. Nonparametric methods are not based on the assumption of normality, and are sometimes referred to as distribution-free methods. If nonparametric methods are required, the most appropriate and current statistical methodology will be followed subject to approval by NMED. The background results will be submitted to NMED.

OPERATIONS SAMPLING METHODOLOGY

Sampling Approach

A stratified random discrete sampling approach has been chosen for quarterly operations sampling at the OD Unit because of the unique contaminant distribution associated with detonation sites. The sampling strategy chosen for the OD Unit differs from a simple random sampling procedure, which is employed at other hazardous waste sites, because concentrations of contaminants are stratified horizontally. That is, the concentration of potential contaminants is greater and most variable at the detonation center and decreases with distance away from the detonation center. The stratified random discrete sampling approach provides two advantages over simple random sampling:

1. The data should be more homogenous within each stratum than in the population as a whole; and

2. Separate estimates of population parameters can be obtained for each stratum without additional sampling.

In general, a stratified random sample is obtained by separating a population into non-overlapping groups, called strata, and then selecting a discrete simple random sample from each stratum. In the case of the 20,000-lb OD Unit, the "population" to be sampled is the potentially affected surface soils in the vicinity of the OD Unit. The term "strata," used in this context, refers to discrete horizontal zones of surface soil, not vertical geologic strata.

Initially, sampling locations will include the area where the unexploded ordnance is placed for destruction and all areas within OD Unit. The OD area will be divided into three strata for sampling purposes: (1) Stratum A, (2) Stratum B, and (3) Stratum C. In addition, samples may also be collected from a Stratum D if concentrations in Strata C are found to exceed the decision criteria. The strata are described in the next section.

Sampling Strata Descriptions

For sampling purposes, the OD Unit will be divided into three strata, each selected to possess a normal contaminant distribution. As described further in this section, sampling weighted by the wind direction at detonation events provide the most conservative measure of potential constituents. Prevailing wind direction will be determined for each detonation episode from the HAFB weather station to ensure that proper sampling locations are chosen following detonation. Table J-3 describes each strata, the expected distribution of residuals, the number of discrete samples to be collected, and the rationale for the chosen sampling depths. The strata are shown in plan view in Figure J-2 and in cross-sectional view in Figure J-3. The strata are also described below.

Stratum A: Depression left by detonation

Stratum A includes the depression created from the detonation event. It is assumed that this area possesses a normal contaminant distribution and is representative of soil directly affected by detonation events.

Stratum B: Depression to Edge of Detonation Area

Stratum B is the intermediate zone between Stratum A and the edge of the active detonation area. (Because a given detonation may be situated anywhere within the 100-ft diameter detonation area,

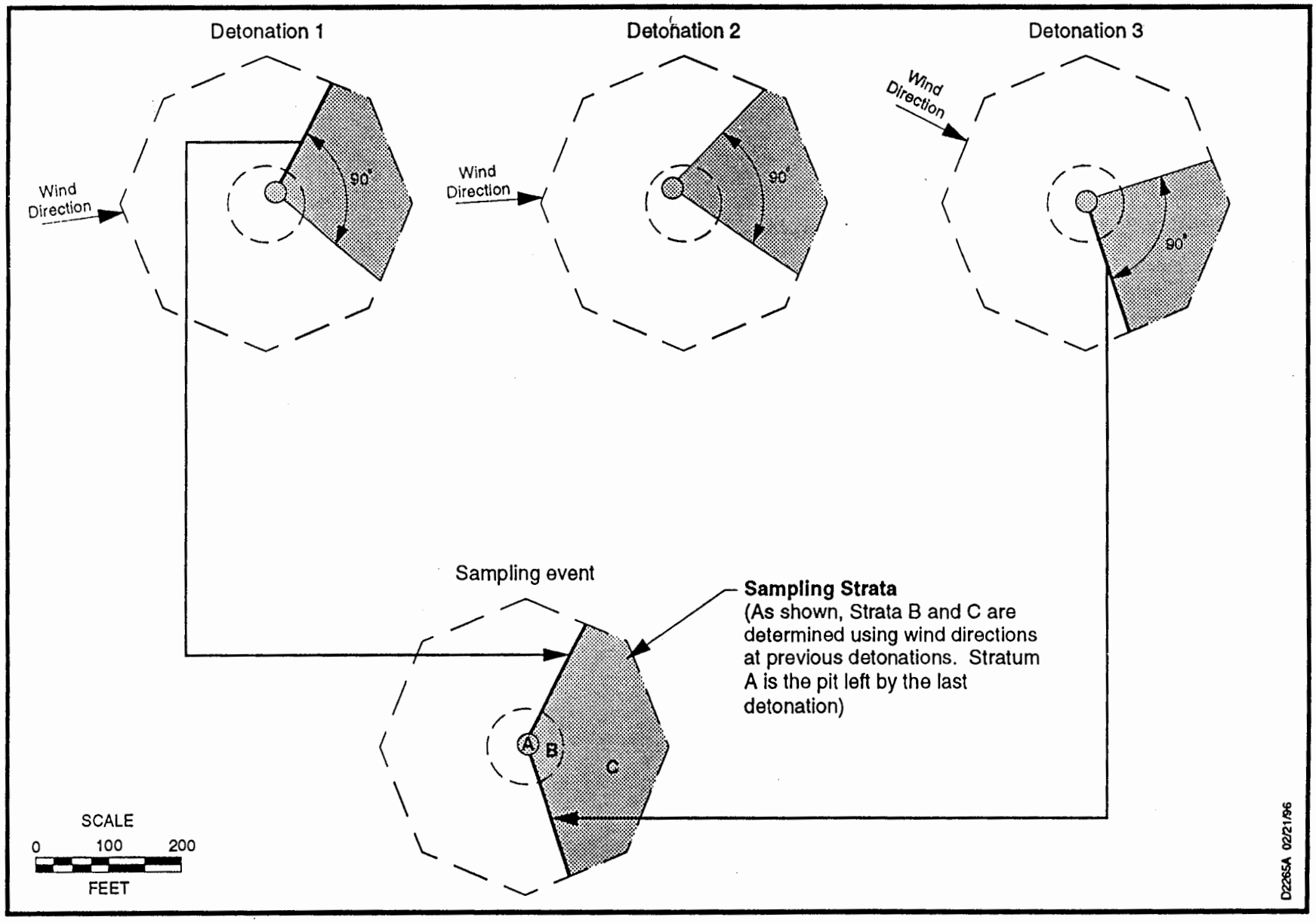


FIGURE J-2: Determination of Strata Geometry Using Wind Direction from Previous Sampling Events.

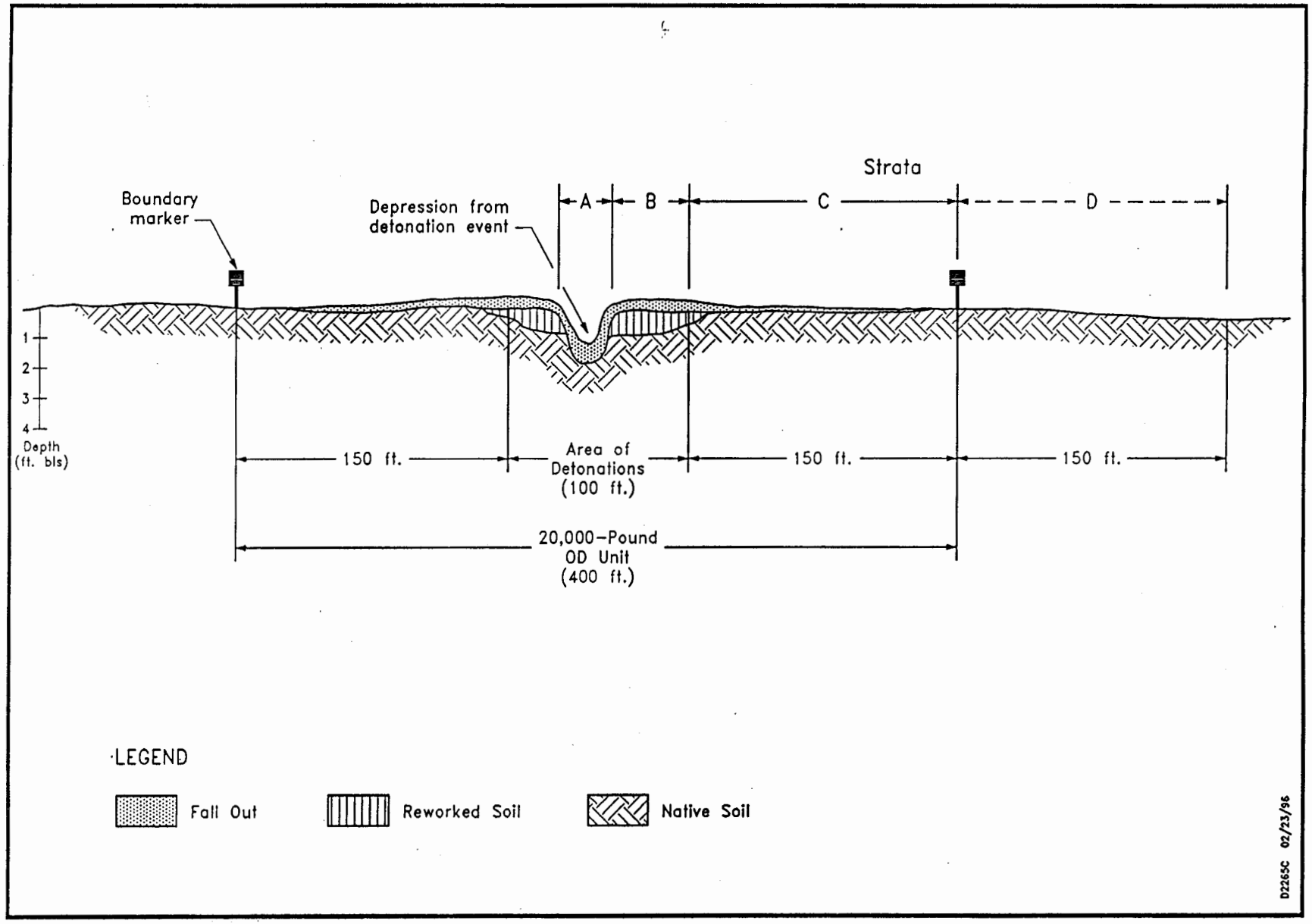


FIGURE J-3: Cross-Sectional View of OD Unit and Strata

the maximum distance from the most recent detonation pit could be 100 ft.) It is assumed that this area contains a normal contaminant distribution. It will contain fallout close to the detonation and may contain areas previously used for detonation that have since been backfilled.

Due to prevailing wind direction, higher concentrations of contaminants could exist in a downwind direction. To compensate for this possibility, the prevailing wind direction will be noted for each detonation period. It is assumed that the area 45° on either side of the prevailing wind direction at the time of detonation will be the most contaminated. Therefore, samples will be collected in this area to produce a more conservative estimate of residual concentration in the soil. Because multiple detonation events may occur between sampling events, wind direction from all detonation events prior to sampling will be considered. Figure J-2 demonstrates how the wind direction will be accounted for in determining the strata. In the example, the three detonations prior to sampling had wind directions varying from northeast to southeast. For each detonation, lines 45° on either side of the wind direction were drawn. Prior to sampling, the angles furthest northeast and southeast were used to create a composite strata diagram for sampling.

Stratum C: Edge of the Detonation Area to OD Unit Boundary

Stratum C is designated as the outer zone situated from the edge of the detonation area to the OD Unit boundary. It is assumed that this area also possesses a normal contaminant distribution, consisting only of fallout from the detonation event. Because no detonations take place in this stratum it is considered distinct from Stratum B.

Similar to Stratum B, higher concentrations of contaminants could exist downwind in Stratum C. To compensate for this possibility, it also will be assumed that the area 45° on either side of the prevailing wind direction at each detonation will be the most contaminated. Using the method described above, the shape of Strata C will be determined.

Stratum D: OD Unit Boundary to 150 ft outside of OD Unit

Because all ejecta outside of the OD Unit will be collected immediately after each detonation and, therefore, the likelihood of leaching to the soil is extremely small, no sampling is planned for Stratum D. A Stratum D will only be used in the event that constituent levels within Stratum C exceed decision criteria. If it is necessary to sample from a Stratum D, the outer boundary of the Stratum will be placed the same distance

away from Stratum C as Stratum C is from B. That is, 150 ft from the edge of the OD Unit. This Stratum, however, is for determining constituent concentrations and will not be considered a new boundary for the 20,000-lb OD Unit.

Sampling Frequency

HAFB will conduct soil sampling quarterly to demonstrate that the OD treatment activities are being performed properly and that residual waste constituents are not contaminating soils above risk-based levels or background concentrations. The operational monitoring sampling must occur within two weeks after a detonation and no site work (backfill, excavation, or construction) will be performed during the time between the last detonation event and the sampling.

After several rounds of quarterly sampling, HAFB will re-evaluate the frequency of operational monitoring sampling. If the data indicate that a reduced sampling frequency (such as semi-annual) is warranted, HAFB will submit a request and justification to New Mexico Environment Department (NMED) to modify the quarterly sampling requirements. Only upon approval by NMED may an alternate sampling frequency be implemented.

Sampling Methodology

Initial Procedures

Before samples are collected, the strata and random sampling locations will be determined. The four random sample locations will be selected from within each stratum using the following procedure:

1. **Delineate Strata:** Prior to the sampling event, the detonation center from the most recent detonation event will be located. The detonation center will be used to determine the exact position of the three strata for that sampling event. Using the strata definitions given above, the three strata (A, B, and C) will be delineated based on prior wind directions and the specified unit dimensions.

2. **Select Random Sampling Locations:** Using the dimensions of the strata, a grid will be placed across each of the strata as shown in Figure J-4. The grid will be of sufficient spacing so that each stratum includes four to six times as many potential sampling locations as the number of samples to be collected (four per strata). Each grid node will then be numbered sequentially from zero (e.g., A0, A1,

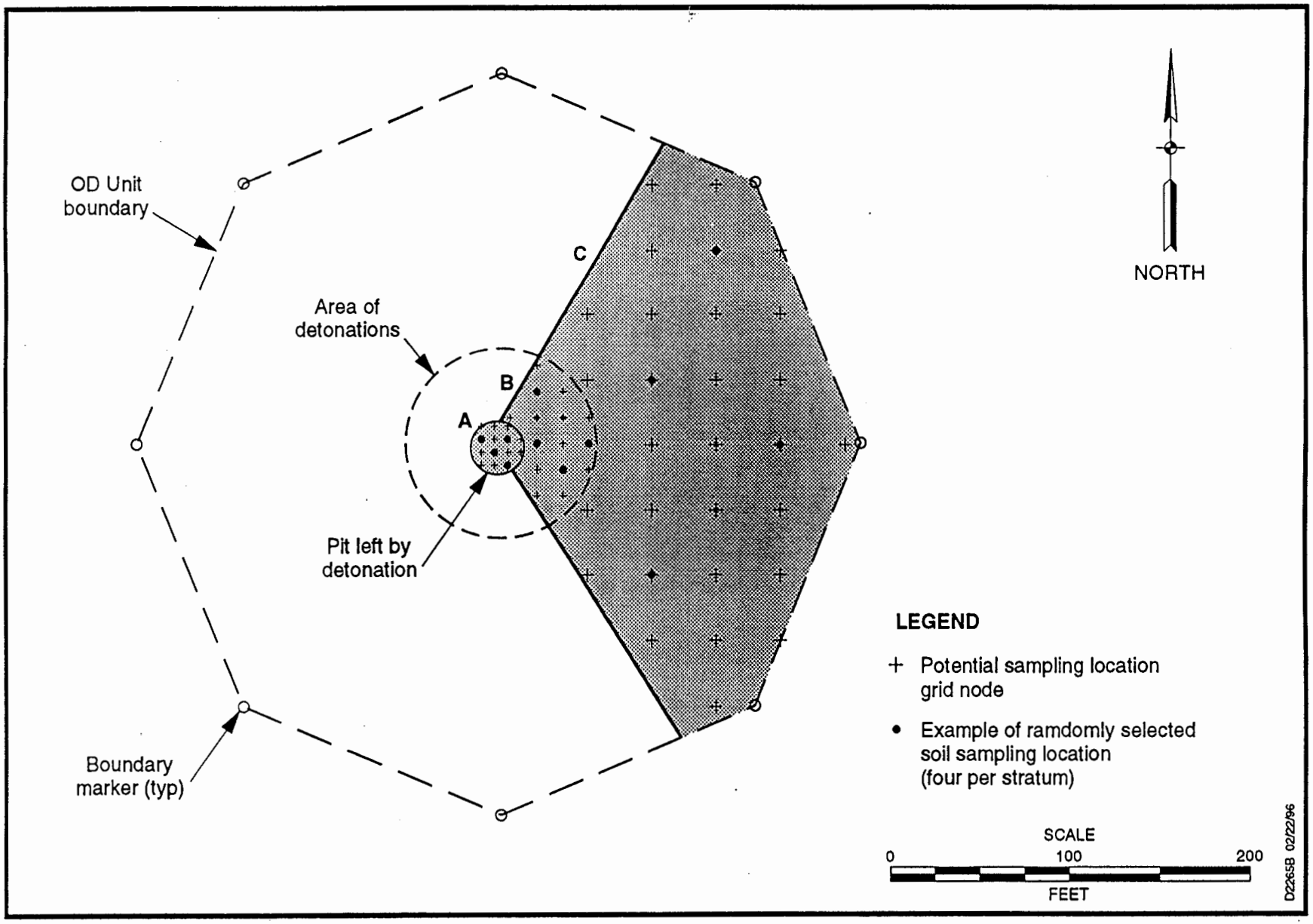


FIGURE J-4: Sampling Strata and Potential Random Sampling Locations

Holloman Air Force Base
Open Detonation Treatment Unit
NMED Control Copy

A2..A28; B0, B1, etc.). To determine the location of each sample, a random number will be generated from 0 to 1. The random number will then be scaled to the range of possible grid nodes. The result rounded to the nearest integer is the grid location to be sampled. Table J-3 illustrates an example of selecting four random samples for stratum C.

Table J-3
Example Calculation of Random Sampling Location Selection

Stratum: C
Number of Samples: 4
Number of Potential Sampling Locations: N = 24
Scale Factor: SF = N - 1 = 23

Formula: Grid Node = Random Number * Scale Factor (round to nearest integer using standard rounding conventions)

Sample Number	Random Number[1]	Scaled Random Number	Grid Node to Sample
1	0.11356	2.61	C3
2	0.78543	18.06	C18
3	0.46786	10.76	C11
4	0.91002	20.93	C21

[1]The random number can be generated using a scientific calculator or spreadsheet.

The analytical test methods listed in Table J-5 were selected based on knowledge of the OD Unit's operational history. HAFB has never been used for the research and development of nuclear, chemical warfare, or other exotic warfare types of weapons. The OD Unit is used solely for the disposal/treatment of conventional waste-ordnance, munitions, incendiaries, single- and double-based propellants, and rocket motors. The only munitions delivered or disposed of at HAFB have been conventional live and training munitions. Therefore, the chemical components and

combustion by-products are consistent with what is typical for military munitions items; thus, the emphasis of sampling and analysis for the OD Unit will be to search only for the constituents present in these types of wastes.

This rationale is supported by the studies conducted to characterize emissions from thermal treatment of explosive munitions (the "Bang Box" studies conducted by Johnson et. al during 1991 and 1993). These studies included emissions analyses for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. Conclusions drawn from the emissions testing of selected ordnance found that VOCs were consistently detected at trace concentrations and that SVOCs were detected at approximately two orders of magnitude less than metals (which are the primary indicators and most persistent form of contamination). Together, this approach supports using the analytical methods described in Table J-4. Analysis for constituents not listed in Table J-4 will be considered only if the mission of HAFB or the operation of the OD Unit changes.

Table J-4
Analytical Methods for Soil Samples

Parameter/ Constituent	EPA Hazardous Waste Number	Test Method	Reference
Explosive Compounds	D003	8330	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
HMX RDX 1,3,5-Trinitrobenzene (TNB) 1,3-Dinitrobenzene (DNB) Tetryl Nitrobenzene(NB) Nitroglycerine 2,4,6-TNT 2,4-DNT 2,6-DNT 2-Nitrotoluene (NT) 3-NT 4-NT			
Toxic Metals			Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
Antimony	--	6010	
Arsenic	D004	6010	
Barium	--	6010	
Beryllium	--	6010	
Cadmium	D006	6010	
Chromium	D007	6010	
Copper	--	6010	
Lead	D008	6010	
Mercury	D009	7471	
Nickel	--	6010	
Selenium	D010	6010	
Silver	D011	6010	
Soil Moisture	--	3550	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).

Quality Control Samples for Post-Detonation Soil Sampling

This section addresses requirements for field QC samples. Quality control in the field begins with adherence to the specified sampling protocols, but is monitored by a variety of samples taken with sufficient frequency to test the quality of measurement results. To measure field related components of quality (i.e., versus laboratory components), duplicates and matrix spike/matrix spike duplicate (**MS/MSD**) pairs will be collected. Table J-5 below explains the field QC requirements and procedures. Because no potential volatile or semi-volatile constituents are present, trip blanks and field blanks would not yield useful QC data and will not be collected.

Table J-5
QC Sample Requirements

Sample Type	Frequency[1]	Purpose	Method
Field Duplicate	10%[2]	To ensure sampling procedures are reproducible and that the sample is representative of the location.	Collect twice the normally required sample volume. Split the sample into two aliquots. Treat each portion as if it were a separate sample and submit for analysis.[3]
MS/MSD	1 pair per 20 samples; or minimum 1 per sampling event	Assess the efficiency of extraction, accuracy of the analysis, and possible matrix effects. The MSD assesses the precision at known concentrations.	Collect twice the normally required sample volume and specify MS/MSD analysis at laboratory.

1 Standard rounding conventions will be used. For example, 10% of 14 samples equals 1 field duplicate; 10% of 15 samples equals 2 field duplicates, etc.

2 Location will be selected from one of the three strata. A different location and strata will be selected for each sampling event.

3 Analytical methods, sample container requirements, and holding times are listed in Table 5-1.

CLOSURE SAMPLING

In the event that the OD Unit is closed, a final round of sampling will be completed. This round of sampling will be conducted after the last detonation event, prior to any site work (grading, construction, landscaping, etc.).

Three strata will be used and their dimensions will be determined based on previous wind directions and the size of the Unit. Four samples will be collected from each stratum at randomly selected grid points. Samples will be collected from the depths indicated in Table J-2 and analyzed for the explosive residues and metals listed in Table J-4. QA/QC procedures, documentation requirements, laboratory protocols, and all other requirements applicable to operations sampling will be followed for the closure sampling.

Because the Closure Plan contained in Permit Attachment F may be modified or amended during the operational life of the OD Unit, the closure sampling protocols in this section will be modified, as necessary, in conjunction with changes made to the Closure Plan presented in Permit Attachment F.

EQUIPMENT DECONTAMINATION, SAMPLE HANDLING, AND CHAIN-OF-CUSTODY (COC)

Contamination Control Procedures

Sampling tools and equipment will be protected from contamination sources before sampling and decontaminated before and between sampling points. Sample containers will also be protected from contamination sources. Sampling personnel will wear clean chemical-resistant gloves when handling the sampling equipment and samples. Gloves will be decontaminated or disposed of between samples.

To prevent cross contamination, sampling equipment will be subject to decontamination procedures following each sample collected at each location. Sampling equipment will be decontaminated in a decontamination zone by being:

- Brush-scrubbed in tap water and Liquinox detergent wash in a tub to remove any soil from the equipment;
- Rinsed in tap water in a separate tub;
- Rinsed with deionized water;

- Rinsed with isopropanol;
- Air-dried in an area upwind of the decontamination process; and
- Stored for future sampling after being wrapped in aluminum foil (shiny side out).

In addition, sampling will first occur in those areas suspected as having the least contamination (Stratum C) and proceed to those areas suspected of having a greater possibility of contamination (Stratum A).

Qualifications of the OD Treatment Unit Soil Sampler

Job Title: Soil Sampler

Duties:

- Collects soil samples using proper sampling techniques for sample collection, proper containers and/or preservatives, and maintains proper field documentation, labeling, packaging and method of shipment.

Required Skills, Experience and Qualifications:

- At least one year's experience in environmental sampling techniques which include soil sampling methodologies.

Required Education:

- At least a high school diploma and the sampler must have successfully completed an EPA approved Hazardous Waste Operations and Emergency Response Course.

An annual review of the initial training or refresher training is required for all personnel that continue in EOD assigned duties.

Health and Safety Procedures

Personnel performing sampling activities will use personal protective equipment such as rubber gloves, boots, aprons, Tyvek coveralls, and eye protection. Personnel will not be permitted to conduct any sampling until they have been cleared by EOD personnel and the high-speed test track security police.

Sampling personnel will be properly trained in hazardous waste and soil sampling, and have a minimum of one year of sampling experience. Personnel will also have 40-hour 29 Code of Federal Regulations (**CFR**) 1910.120 Occupational Safety and Health Administration (**OSHA**) training and appropriate medical monitoring and certification. Sampling personnel will also be informed by HAFB EOD personnel on the hazards of sampling soil disturbed by explosive compounds.

Chain-of-Custody (COC) Procedures

COC procedures will be followed to track possession of the samples from the time they are collected in the field until the analytical data from the samples are received and recorded. For all soil samples, procedures will begin once sampling is complete. A sample will be considered under custody if it is:

- In the possession of the sampling team;
- In view of the sampling team;
- Placed in a secure area by the sampler; or
- Transferred to a secure area.

An area is considered secure only when it is locked and access is controlled. The sampling team leader is responsible for custody of the collected samples in the field until they have been properly transferred to the shipping coordinator, who is responsible for sample custody until the samples are properly packaged, documented, and released to a courier or directly to the contract analytical laboratory. A triplicate COC record form will be used for the sampling effort.

Sample Container and Preservation Requirements

Samples will be collected in pre-cleaned sampling containers and will be kept cold during transportation and shipping. Table J-6 summarizes the containers, preservation, and holding time requirements for the samples to be collected. Laboratory-specific container requirements will be verified with the contracted analytical laboratory prior to sample collection.

Table J-6

Summary of Sample Container, Preservative, and Holding Time Requirements for Soil Samples

SW 846 Method	Analyte	Container	Preservative	Holding Time
6010	Metals (As, Sb, Ba, Be, Cd, Cr, Cu, Pb, Ni, Ag, Se)	500-mL wide-mouthed glass or plastic jar	None, cool, 4°C	6 months for digestion and analysis except for mercury which must be digested and analyzed in 28 days.
7471	Mercury			
8330	Explosive residues	500-mL wide-mouthed glass jar with Teflon-lined cap	None, cool 4°C	14 days to extraction 40 days after extraction

Packaging and Transportation

At the end of each sampling day, samples will be packaged in shipping containers with double-bagged ice packs to maintain a temperature of less than 4°C. The samples will be carefully packaged so that they will not break during shipping and will contain absorbent material capable of containing all liquid. Each shipping container will be sealed with custody seals and shipped to the analytical laboratory by an overnight delivery service.

DOCUMENTATION OF SAMPLING AND ANALYSIS ACTIVITIES

Sample Identification

Sample containers will be uniquely identified to indicate the site, the individual composite sample's location, the treatment unit, and date. Examples of a sample code for the three sampling zones are listed below:

- 20K-A01-110595 (OD Unit sample number 01 taken within Stratum A on November 5, 1995);
- 20K-B01-110595 (sample number 01 from Stratum B of the OD Unit taken on November 5, 1995); and

- 20K-C01-110595 (sample number 01 from Stratum C of the OD Unit taken on November 5, 1995).

Sample locations will be triangulated from existing OD Unit boundary markers so that the exact location can be determined if necessary. This information will be recorded in the field sampling book.

Sample Labels

The samples collected will be identified by an adhesive label containing the following information:

- Collector's initials;
- Sample ID;
- Analytical methods requested;
- Place of collection (facility and location);
- Date sample taken; and
- Time sample taken.

Any other information required by the laboratory or deemed necessary by project personnel will also be added to the label.

Field Sampling and Unit Operation Logbooks

All the methodology, procedures, and events pertaining to sample and data acquisition will be recorded in bound, water-resistant field logbooks with a black waterproof ink pen. The logbooks will be considered formal documents representing a complete and organized record of all field activities. The entries will include, but not be limited to the following:

- Personnel present; Name of Sampler(s);
- Date and time of every recording;
- Work location;
- Description of work and treatment process;
- Purpose of sampling;
- Soil sample descriptions;

- Description and location of area sampled;
- Sample numbers;
- Field QC data;
- Other important notes on field activities, conditions, or problems; and
- Initials/signature of person entering data.

Entries made in the logbook should be of sufficient detail to enable a third party to reconstruct the sampling event, and sample location by the reading of the entries and information recorded in it. No erasures or deletion marks will be permitted. If a mistake is made in a logbook, it must be corrected by marking a line through the error and initialing. The correction may be made in the space available on the page.

LABORATORY ANALYSIS

Laboratory Specifications

Design and execution of the testing program will be coordinated with an analytical chemist experienced in contaminated soil testing. The laboratory procedures and QA/QC specifications will follow those described above. The following is a summary of these laboratory specifications and procedures.

At a minimum, the laboratory report will state the following:

- Unique laboratory ID;
- Field sample ID;
- Sampling date;
- Preparation date;
- Analysis date;
- Preparation batch;
- Preparation method;
- Analysis batch;
- Analysis method;
- Analyte;
- Results;
- Footnotes;
- Units;
- Sample matrix;
- Sample-specific detection limit;
- Dilution factor;
- Matrix spike recoveries;

- Surrogate spike recoveries (for all samples, blanks, and laboratory QC samples);
- Case narrative (if necessary);
- Dry weight;
- Blank sample results; and
- Laboratory control sample results.

The laboratory will be required to achieve the required detection limits as specified in SW-846. Equivalent analytical methods will be used following approval by NMED.

Soil samples will also be analyzed for soil moisture content, in accordance with SW-846. The contracted laboratory will report uncensored data for all analytical results. Regardless of the analytical measurement result, it will be reported without qualitative descriptors such as "not detected," "less than," etc.

QA/QC Protocols

For all inorganic tests, the samples will be spiked with known quantities of the hazardous constituent and spike concentration and percent recovery reported. For organic tests, the samples will be spiked with a subset of target analytes. The surrogate spike recoveries will be reported for all organic tests. Results from method blanks on the samples will be submitted. Blank results will not be subtracted. The method of how the reported lower detectable limit was determined must also be reported. To ensure that the established data quality objectives (**DQOs**) can be attained, the level of analytical quality achieved will be at least Level III. Data will be sufficiently documented to allow personnel to review and evaluate data quality and have all reporting requirements to achieve Level III data quality. Level III data will allow HAFB to determine whether, based on the results, the OD treatment process is affecting the environment.

As a quality assurance measure, the contracted laboratory will also be required to participate in the U.S. EPA Water Pollution and Water Supply studies which include blinded performance evaluation samples.

Measurement Quality Indicators

DQOs are quantitative and qualitative statements specified to ensure that data of known and appropriate quality are obtained during soil sampling. The overall objective of sampling is to provide an accurate, precise, and representative confirmation

that the OD Unit treatment process is not contaminating surrounding soils above risk-based levels or background levels. DQOs will be followed in terms of precision, accuracy, representativeness, completeness, and comparability (**PARCC**). The PARCC parameters indicate measurement data quality. The procedures described in this section are designed to obtain PARCC for each sampling and analytical method and analysis. The PARCC parameters will be evaluated after each round of sampling.

Precision

Precision is a measure of variability between duplicate or replicate analyses, and is calculated for field and laboratory replicates. By definition, field or total, precision incorporates laboratory precision. Precision is calculated as the relative percent difference (**RPD**) between duplicate samples or analyses, or matrix spike/matrix spike duplicates as appropriate. The calculated RPDs are compared to the objectives stated in the method. Results that do not satisfy the objectives are assigned a data qualifier flag indicating uncertainty associated with imprecision.

An average RPD may be calculated and reported as a measure of overall analytical precision for compounds with multiple measurements. The specific samples collected or analyzed in duplicate are flagged if they do not satisfy the QA objectives. In addition, associated samples may be flagged to indicate variability due to poor precision. For poor field duplicate precision, samples collected by the same sampling team, from the same equipment, or on the same day may be affected; close evaluation of those results should indicate the most likely source of variability, and the corresponding samples will be qualified as warranted. For poor laboratory precision, samples processed and analyzed in the same batch will be more closely evaluated, and any anomalous result will be qualified.

The QA coordinator is responsible for ensuring that data qualifier flags are assigned to the data as required by the established QC criteria, and that they are reported and understood by project staff using the data for specific applications.

The QA coordinator is also responsible for initiating corrective actions for analytical problems identified during the QC data assessment process. These corrective actions range from verifying that the method was in statistical control during the analytical runs, to re-analysis of the sample, or resampling.

Accuracy

Accuracy is associated with correctness, and is a comparison between a measured value and a known, or 'true' value. Accuracy is calculated from method spike (spikes of the pure matrix) matrix spike, or Laboratory Check Sample results.

Spike results are reported by the laboratory as percent recovery and are compared to the accuracy objectives stated in the method. Results that do not satisfy the objectives will be assigned a data qualifier flag to indicate uncertainty associated with inaccuracy.

Method spikes are spikes of a reference material into a water matrix. If recovery is outside the established limits, samples from the same extraction batch may be qualified. Matrix spike results are generally more sample-specific. If matrix spike recovery is outside the established limits, results for samples collected from similar conditions and/or handled in the same batch will be examined. If any results appear atypical and could be related, those results may also be qualified. The flagged data will be discussed in the QA/QC report for the sampling task, and specific limitations such as poor or enhanced recovery for specific compounds will be stated. Further investigation or corrective action may be taken to find methods to reduce the interferences.

Surrogate spike results are also reported and used to assess recovery of target analytes on a sample by sample basis and provide a measure of system performance. Surrogate spike recoveries are compared to recovery limits. Any results outside the limits are flagged on laboratory reports and in the database. Any corrective action taken in the laboratory will be documented in laboratory performance records and/or discussed in the comment section of the analytical data report.

Confidence intervals can be calculated for an analytical method if performance evaluation samples are submitted or a series of method spikes is analyzed. The results will be used to define confidence intervals for the recovery of each compound analyzed.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criterion is satisfied by carefully selecting sample locations, sampling techniques, and

analytical techniques and collecting a sufficient number of samples. Adherence to this SAP will ensure that sufficient representativeness has been achieved.

Completeness

Completeness will be calculated after the QC data have been evaluated, and the results applied to the measurement data. In addition to results identified as being outside of the QC limits established for the method, broken or spilled samples, or samples that could not be analyzed for any other reason are included in the assessment of completeness. Analytical results for methods or analytes outside the established QC limits are considered questionable and are unusable for the RI and risk assessment. These results will be considered invalid and will be flagged with an "R". The percentage of valid results is reported as completeness.

Completeness will be calculated as follows:

$$\frac{T - (I+NC)}{T} \; x \; 100\% = \textit{Completeness.}$$

where: T = Total number of expected measurements for a method and matrix;

I = Number of invalidated results for a method and matrix; and

NC = Number of results not collected (e.g., bottles broken etc.) for a method and a matrix.

Comparability

Comparability reflects the confidence with which data sets can be compared to each other. This is accomplished through use of standard sampling techniques for all sampling events and standard analyzing techniques for all samples. Comparability is limited to the precision and accuracy parameters of PARCC, because only when these parameters are known can data sets be compared with confidence.

Blank Data Assessment

Reagent blank results indicate whether any of the contaminants reported in sample results may be attributed to laboratory sources (reagents, glassware, instrumentation) and were not likely present in the sampled medium. The most common laboratory contaminants are methylene chloride, phthalate, acetone, and toluene; these are recognized as being ubiquitous in the laboratory environment and controlling them to within acceptable low levels is part of standard laboratory procedures.

If contamination from these compounds is reported in reagent blanks, the samples associated with the blank, either the same analytical or extraction batch, may be qualified to indicate that some or all of these compounds may be from laboratory sources. If the concentrations reported in the samples are similar to the blank concentrations, it is likely that all of the contamination was introduced, and this assessment is made in the QA/QC report for the sampling task.

In some cases, where there is a large sampling task and reagent blank results indicate a more significant contamination problem, a more systematic approach may be applied. This approach is only used when a series of reagent blanks analyzed over a period of time are reported. The assessment criterion is calculated from reagent blank results as the mean concentration plus three standard deviations for each contaminant reported. The sample data are assessed using this criterion. Sample concentrations below the criterion are considered to be most likely from laboratory sources, and at least some of the sample concentrations higher than that are considered to be from the sampled medium. This semi-quantitative approach is used only as a tool to screen the sample results and provide a common basis for further assessment; none of the results are censored or changed in any way. The assessment is discussed in a QA summary report for the sampling task. Samples with blank contamination problems will be assigned a data qualifier flag.

Sample Return or Disposal

Unless directed otherwise by HAFB, the laboratory will dispose of all soil samples following analysis. The laboratory will provide certification that its facilities qualify for the exemption in 20 NMAC 4.1, Subpart II, §261.4(d), which excludes waste samples from many hazardous waste management requirements. In addition, all laboratories will provide the base with an explanation of the disposal practices used with respect to sample residuals.

DATA EVALUATION METHODS

To determine if operations at the HAFB 20,000-lb OD Unit are adversely affecting the soil at the subject site, the sampling results will be compared to site specific action levels. If constituent concentrations in the strata exceed action levels, further evaluation will be triggered. The following sections explain the action level determination, describe the comparison process, and list the potential remedial responses in the event of an exceedence of action levels.

Action Level Determination

The action levels for the potential contaminants at the HAFB OD Unit are derived from two sources: (1) the background upper tolerance limit (**UTL**), as calculated from the site-specific background sampling; and (2) calculated risk-based values. The UTL will be calculated using standard EPA statistical methods (EPA, 1992). Risk-based values will be calculated in accordance with the most current EPA guidance and toxicity data.

Comparison of Sampling Results to Decision Criteria

All valid analytical data from sampling activities will be compared to the action levels to determine if a significant release of the targeted explosive and metal compounds has occurred. Analytical results will first be compared to background UTLs and if an exeedence occurs, the concentration will then be compared against the risk-based concentration for that analyte. Every sample from each stratum will be compared individually to the action levels. In order to more fully understand the distribution of potential exceedences across a stratum, additional statistical tests will also be performed on a per-stratum basis.

Sampling results will be evaluated against actions levels after the analysis has been performed and the data has undergone QA/QC evaluation (typically 30 to 60 days from the time of sampling).

Data Resolution and Remedial Response

In the event that soil sampling results show that an action level has been exceeded at any sampling point, the sampling point will be immediately resampled to confirm the presence of contamination. If resampling confirms constituent concentrations in excess of the action level, the occurrence will be noted, NMED will be duly notified in writing, and a report describing the

occurrence will be submitted to NMED within seven days of the sample confirmation.

For areas where contamination has been verified to exceed action levels, HAFB, in accordance with NMED, may choose to further evaluate the exceedence using a site-specific risk-based approach, additional sampling results, or remediate affected soils. To prevent future contamination the HAFB OD Unit operations will be reevaluated and modified, as appropriate.

Each of these potential solutions will require coordination with NMED and will be completed in a timely manner to help minimize the potential spread of contamination and risk to human health and the environment.

Determination of Stratum D

Stratum D, which will consist of an area 150 feet outside of Stratum C, will only be sampled in the event of an exceedence in Stratum C. If sampling in Stratum C shows levels below action levels, it will prove that constituent concentrations outside of Stratum C are also below action levels. If levels above action levels are measured in Stratum C, then it is unknown whether concentrations outside of the OD Unit also exceed action levels, and a Stratum D will be created to test the concentrations. Four discrete random samples will be collected from Stratum D, using the same sampling methodology described above.

This stratum, however, is for determining constituent concentrations only and the boundary of the 20,000-lb OD Unit will not be moved to include the sampling Stratum D.

REFERENCES

Draft Closure Plan, 300-lb Open Burn Area. Radian Corporation. April, 1995.

Elementary Survey Sampling. William Mendenhall et al., 1971. Pages. 53-64.

Hahn, Gerald J. and William Q. Meeker, 1991. *Statistical Intervals, A Guide for Practitioners*.

Sampling Techniques. William G. Cochran, 1977. Pages 89-149.

SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2. SAS Institute, 1989.

Shapiro, S.S., and M.B.Wilk, 1965. "An Analysis of Variance Test for Normality (complete samples)," Biometrika, 52, Pgs. 591-611.

Understanding Robust and Exploratory Data Analysis, David C. Hoaglin, Frederick Mosteller, and John W. Tukey, 1983. John Wiley and Sons, Inc.

U.S. Environmental Protection Agency (EPA), June 1992. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Addendum to Interim Guidance*, Office of Solid Waste, Washington, D.C.

U.S. EPA, November 1986. *Test Methods for Evaluating Solid Waste*, SW-846, 3rd Edition, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. EPA, October 1993. *Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process*, EPA QA/G-4.

PERMIT ATTACHMENT K

ENVIRONMENTAL PROTECTION

INTRODUCTION:

The following information was provided to the New Mexico Environment, Hazardous and Radioactive Materials Bureau in compliance with the requirements of New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, Subpart V, §264.601(a-c).

Site Characteristics

A detailed description of the characteristics of the OD Treatment Unit (i.e. geology, meteorology, and soils) is contained in Permit Attachment I, Standard Operating Procedures, hence will not be duplicated here.

AIR QUALITY ASSESSMENTS:

Potential for Emission

There is minimal potential for the release of any gases, aerosols, or particulates from the open detonation activities into the air that would adversely affect human health or the environment. There is at least a five mile (8 km) radius surrounding the OD treatment unit that is barren, undeveloped, and uninhabited. The primary concern is the impact of the waste constituents on soil around the OD treatment Unit.

However, since minimal potential exists for particulates in soil to be released into the air, perimeter soil samples will be collected surrounding the area of operation, as described in Permit Attachment J (Sampling and Analysis Plan). If contaminant concentration levels above background are reported for soil samples, a risk assessment as described in Module III, Section E., page 3, will be completed; and air and ground water monitoring will be conducted. Air modeling will not be performed prior to the commencement of the proposed OD operations as demonstrated in Permit Attachment M.

Justification for not Doing Air Monitoring:

The destruction of the explosive and propellant devices is nearly 100% because they are designed to explode or burn. Unlike other installations that treat explosive contaminated materials, for example, this unit treats only explosive and propellent products.

Also, there are no receptors near the OD unit and it is in a secure, impact area.

Effectiveness of Control

Current control systems of OD operations are conducted within designated areas and the OD pits within the excavated treatment unit, and OD operations are conducted only during favorable wind conditions as described below. OD treatment efficiency is sufficient that these control systems should protect human health and the environment. To prove this the waste analysis plan described in Permit Attachments A and J, will be implemented to establish soil quality and the potential spread of contamination.

Operational Conditions

No treatment operation will be conducted during an electrical storm or when such a storm is approaching within 10 miles [16 kilometers(**km**)] of the OD unit. Additionally, disposal by detonation using an electrical firing system will not be conducted during sand, dust, or snow storms.

It is recognized that weather factors are interdependent. Therefore, in order to evaluate the weather conditions for disposal operations, the weather factors must be considered collectively. The following safety precautions will be observed:

1) Wind speed will not be less than 3 miles per hour and will not exceed 15 miles per hour (5 km , and 24 km per hour respectively).

2) Cloud cover will not be greater than 50%.

3) Demilitarization operations will occur only during lapse temperature gradient conditions.

The temperature gradient is the difference obtained by subtracting the air temperature at 1.6 ft (0.5 m) above the ground surface from the air temperature at 13.1 ft (4 m) above the ground. Estimation of temperature gradient is as follows:

- Strong lapse conditions (temperature gradient -2° to -3°F (-18.9° to -19.4°C)) will occur near midday when the sky is clear of clouds, the sun is bright, and the wind speed is low.

- Weak lapse conditions (temperature gradient 0° to -1°F (-17.8° to -18.3°C)) will occur during midmorning and midafternoon provided that the sky is clear, the sun is bright, and the wind speed is low. They also occur on partly cloudy days and when the wind speed is moderate.

- Neutral conditions (temperature gradient 0°F (-17.8°C)) generally will occur at sunrise and at sunset on clear days and will exist throughout the day whenever the sky is overcast or any time when there are strong winds.

- Inversion conditions (temperature gradient 0°F to +3°F (-17.8° to -16.1°C)) generally will occur throughout the night when the sky is clear and the wind speed is low.

Existing Air Quality/Other Sources/Receptors

The air quality in Otero County, New Mexico where the subject site is located, is in compliance with air quality standards. There are no areas of non-attainment in Otero County and no major air emission sources. The 20,000 Pound OD Unit at Holloman AFB is in an attainment area and the surrounding air quality is good.

Operations at the OD treatment unit are not expected to adversely impact the air quality of Otero County. OD treatment activities are very efficient and, particularly at this remote site, are not expected to degrade air quality so as to impact the environment or human health.

The potential public receptors in the area are far removed (at least 5 mi (8 km)) from the site. The HAFB EOD team members who will conduct the treatment operations will be at safe distances for the OD unit. Vehicle traffic due to OD operations has negligible impact on air quality.

Conclusion:

In conclusion, OD operations are very efficient due to the reactive nature of the hazardous propellants, explosives, and pyrotechnics (PEP), and there are no receptors in close proximity to the OD treatment unit. Current air quality is excellent and OD operations will not significantly impact it.

POTENTIAL EXPOSURE PATHWAYS

The public is denied access to the OD treatment unit by a number of mechanisms. These include HAFB Security Police, and the remoteness of the OD unit from human habitation. Access is only provided to the HAFB EOD personnel during OD operations. No one is allowed at the OD treatment unit during open detonation activities.

Time Before Detonation

Before each OD activity, the PEP hazardous wastes are expeditiously placed in the appropriate above ground treatment area, initiation materials are applied, and after retreat by the EOD personnel to a specified safe distance, the ignition is accomplished by remote control. The precise times between PEP arrival and placement, initiator placement and ignition, vary. However, because no waste is stored at the unit all activities will occur between 7:00 am and 5:00 pm of the same day.

Time After Detonation

After the OD operation, EOD personnel will return to the treatment unit within 24 hours to inspect for unexploded ordnance (**UXO**) and kick-outs, when it has been determined that it is safe to do so. This drive time and the required wind speed (greater than 3 knots (5.6 km per hr)) is considered sufficient by EOD procedures to protect the EOD specialists from any gases, vapors, or airborne particulates resulting from the OD operations.

Management of Waste Residues

The treatment unit currently has no visual indication of ash or other chemical residue. There are a few metal fragments identifiable within the OD unit. Any metal fragments and remnants resulting from OD operations will be collected after every treatment activity. The fragments so collected will be placed into appropriate containers, and handled as RCRA hazardous waste.

HAZARDOUS WASTE MIGRATION POTENTIAL

Assessment of Hazardous Waste Migration Potential to the Uppermost Saturated Zone

In summary, factors supporting the determination that there is no hazardous waste migration potential to the uppermost saturated zone include the following:

- Waste munitions are transported to the OD Unit in their original containers or casings, which are designed for

long-term stability and thus ensure that no wastes are inadvertently released to the environment prior to treatment. In addition, no free liquids are included among the wastes treated at the OD Unit.

- All OD Unit waste treatment activities are conducted on the ground surface. No trenches or pits will be excavated to contain the wastes.

- The OD Unit thermal treatment process generally ensures complete destruction of the waste. Residual waste munitions compounds become nonhazardous once detonation occurs. Organic constituents of the wastes are converted to gaseous products such as CO, CO_2, and N_2 during thermal treatment thereby eliminating the hazardous characteristics of the wastes. Explosive compounds generally have very limited solubility in water further minimizing potential for vertical leaching.

- The metal debris remaining after thermal treatment of the wastes is typically present in elemental states or as oxides that are insoluble or of limited solubility in water, thus eliminating the potential for metallic compounds to migrate through the soil or into surface water or groundwater.

- The low precipitation rate for the area results in a negligible driving force for hazardous waste contaminant migration. The annual precipitation at Holloman AFB averages 7.9 inches. The mean annual evapotranspiration rate averages an estimated 67 inches per year resulting in a net annual precipitation rate for the area of approximately -59 inches per year.

- At all four monitoring well locations near the OD Unit (Figure G-5), a low permeability silt/silty clay unit was encountered between 10 to 15 feet deep. Drilling records indicate that this unit ranges from approximately 2 to 7 feet thick. This low permeability unit acts as a barrier preventing or minimizing any potential vertical hazardous waste contaminant migration.

- The depth to the uppermost saturated zone beneath the OD Unit ranges from 27 to 31 feet below ground surface. Because the net annual precipitation rate averages an

estimated -59 inches per year, it is extremely unlikely that hazardous waste contaminants could migrate to the uppermost saturated zone.

Hydrological Characteristics

Surface water resources within the Tularosa Basin are limited by the high evapotranspiration rate and low annual rainfall. The majority of surface water in the basin is either lost to evaporation, transpiration, and infiltration or collects in the lowest point in the basin at or near Lake Lucero, located at the southwest edge of the gypsum dune field approximately 30 miles southwest of the OD Unit. The Base is crossed by several southwest trending arroyos or draws which control surface drainage in the undeveloped part of the Base (including the OD Unit). Surface drainage near the OD Unit include the Allen Draw, the Reagan Draw, and the Guilez Draw (Figure G-4, Permit Attachment G). In the vicinity of the OD Unit, surface water flow is only associated with infrequent heavy rainfall or snow melt events. The OD Unit is located on relatively flat terrain far above the 100-year floodplain boundaries.

Water Balance

Low annual precipitation rates coupled with the high evapotranspiration rate means that there is minimal infiltrating water into the subsurface. With minimal infiltrating water there is minimal potential for leaching of constituents to the uppermost saturated zone.

Unsaturated Zone Soil Characteristics

The potential for migration is further limited by the geologic and hydrogeologic conditions at the OD Unit. The unsaturated soil characteristics are described in this section.

The U.S.D.A. Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex and the Mead silty clay loam:

The Holloman-Gypsum Land-Yesum complex is representative of the surface soil found throughout the Base (including the OD Unit area). The soils of this association are formed from alluvial and eolian (wind blown) gypsiferous sediments. The Holloman unit makes up about 35% of the complex. It is a very fine grained, sandy loam with a high gypsum content. The soil is moderately permeable, calcareous, and mildly alkaline.

The Gypsum Land unit makes up about 30% of the complex. It is soft to hard gypsum, typically overlain by less than one inch of very fine sandy loam. The Yesum unit, which makes up approximately 20% of the complex, is a very fine sandy loam that is also high in gypsum. It is moderately permeable, calcareous, and mildly alkaline.

Depth to the Uppermost Saturated Zone

The depth to the uppermost saturated zone decreases from 270 feet below the ground surface (**BGS**) (or more) near the base of the mountains to less than 40 feet BGS at Holloman AFB. Normal, seasonal water table fluctuations of up to 2.58 feet have been measured at Holloman AFB with the water table standing higher in the spring than in the fall. The water table depth beneath the OD Unit ranges from approximately 27 to 31 feet BGS.

GROUNDWATER MIGRATION POTENTIAL

Assessment of Groundwater Migration Potential

This section presents information on the potential for migration of contaminants within the uppermost saturated zone. In summary, migration of contaminants within the uppermost saturated zone is considered negligible because of the following:

- An approximate groundwater flow velocity of 14.7 feet per year and hydraulic conductivity values averaging 3.47×10^{-4} feet/minute suggest an extremely low potential for hazardous waste contaminant migration in the uppermost saturated zone. Contaminants seldom move at the advective transport velocity of groundwater and generally move at much slower rates because of adsorption to soil particles and other processes;

- Natural total dissolved solids (**TDS**), chloride, and sulfate concentrations at the OD Unit all exceed New Mexico Human Health Standards (**NMHHS**). According to the New Mexico Water Quality Control Commission Regulations (**NM WQCC** 82-1, as amended through August 18, 1991, Parts 3-100 through 3-103), the groundwater below the OD Unit is designated as unfit for human consumption because it exceeds NMHHS for TDS, sulfate, and chloride. Furthermore, based on the *Base-Wide Background Study* (Radian, 1993), the upper tolerance limit for selenium also naturally exceeds NMHHS standards for groundwater;

- No water supply wells are located on the Base due to poor water quality. The nearest well of any kind is a livestock water supply well located approximately 3.5 miles southwest of the Base; and

- There is no risk associated with the groundwater in the vicinity of the OD Unit since the resource is not used as a domestic, industrial, or agricultural water supply and in all likelihood will never be used as a resource.

Saturated Zone Characteristics

Hydrogeologic Characterization

Ground water occurs in unconfined conditions in the unconsolidated bolson deposits beneath Holloman AFB. The primary source of recharge for groundwater in the bolson fill is percolation of rainfall and stream runoff through the coarse, unconsolidated alluvial fan deposits along the western flank of the Sacramento Mountains. Water migrates downward into the bolson fill and flows downgradient through progressively finer-grained sediments into the basin. The hydraulic gradient is steep along the recharge zones at the base of the mountains, but then flattens out as groundwater migrates into the valley. Groundwater discharge occurs either through evapotranspiration, springs or seeps along steep-sided arroyos, or into closed playa lakes such as Lake Lucero, the regional groundwater discharge area approximately 30 miles southwest of the OD Unit. The regional groundwater flow beneath the OD Unit is southwesterly toward the center of the basin.

Saturated Zone Physical Properties

The saturated zone beneath the OD Unit begins approximately 27 to 31 feet BGS. The cross-section in Figure G-6 shows that the top of the saturated zone at HAFB OD monitoring well **MW**01 is located within the upper portion of the silty clay unit. The wells to the south and southwest show that the top of the water table is within the eolian sediments (fine to medium grained silty sand), above the silty clay. This indicates that the downgradient wells are in coarser grained material, with greater permeability and porosity.

Four aquifer slug tests were conducted in the four wells installed during the May 1993 OD Unit investigation (HAFB/EOD-MW01, MW02, MW03, and MW04). The data collected were from rising head tests. The Bouwer and Rice analytical method was chosen to

analyze the hydraulic conductivity. The computer generated hydraulic conductivity results are presented below:

- HAFB/EOD-MW01 = 2.42 x 10^{-4} ft/min.;
- HAFB/EOD-MW02 = 5.30 x 10^{-4} ft/min.;
- HAFB/EOD-MW03 = 1.03 x 10^{-4} ft/min.; and
- HAFB/EOD-MW04 = 1.46 x 10^{-4} ft/min.

EXISTING GROUNDWATER QUALITY

Overall water quality in the Tularosa Basin varies with the distance from the recharge areas. Regions of groundwater recharge near the mountain escarpments have the best water quality. Wells installed in the alluvial fans that surround the valley floor are used for domestic and agricultural purposes. Water percolating through sediments high in gypsum, limestone, and dolomite becomes highly mineralized. Ground water in the Tularosa Basin beneath Holloman AFB contains concentrations of total dissolved solids (TDS) ranging from 3,100 milligrams per liter (mg/L) to 41,000 mg/L. Sulfate concentrations range from 1,700 mg/L to 6,700 mg/L. In general, the high concentrations of TDS and sulfate in the Tularosa Basin make groundwater unusable for domestic or agricultural water supplies and can be classified as Class III B groundwater (not considered a source or potential source of drinking water) under EPA guidelines.

At the OD Unit, groundwater samples were collected from the four wells (HAFB/EOD-MW01, 02, 03, and 04) installed during the 1993 OD Unit investigation and submitted for laboratory analysis. TDS, chloride, and sulfate concentrations at the OD Unit were all found to exceed New Mexico Human Health Standards (**NMHHS**). TDS, sulfate, and chloride analytical results from the OD Unit monitoring wells are presented below in Table K-1.

Table K-1

Summary of Results 20,000-Pound OD Unit Investigation

Constituent	Concentration Range (mg/L) (OD Unit Monitoring Wells)	NMHHS (mg/L)
TDS	5,050 - 5,700	1,000
Sulfate	3,330 - 4,100	600
Chloride	565 - 628	250

According to the New Mexico Water Quality Control Commission Regulations (NM WQCC 82-1, as amended through August 18, 1991, Parts 3-100 through 3-103), the groundwater below the OD Unit is designated as unfit for human consumption because it exceeds NMHHS for TDS, sulfate, and chloride. Furthermore, based on the *Base-Wide Background Study* (Radian, 1993), the upper tolerance limit for selenium also naturally exceeds the NMHHSs for groundwater.

GROUNDWATER DIRECTION AND FLOW RATE

Based on groundwater elevation measurements collected in May 1993, the direction of groundwater flow beneath the OD Unit is to the southwest. An OD Unit groundwater contour map is presented in Figure K-1. The hydraulic gradient shows that the groundwater drops one vertical foot for every 41.4 feet traversed horizontally. No surface features were found to have an effect on the groundwater flow direction.

Groundwater flow velocity was calculated using a basic advective transport equation derived from Darcy's Law. To compensate for the increasing hydraulic conductivity values southwest of the OD Unit, an average hydraulic conductivity was calculated between the finer grained material (HAFB/EOD-MW01, 03, and 04) and the coarser grained material (HAFB/EOD-MW02). Using an average hydraulic conductivity value of 3.47×10^{-4} feet/minute, a groundwater flow velocity of 2.79×10^{-5} feet/minute was calculated. Groundwater at this velocity will flow approximately 14.7 feet per year to the southwest.

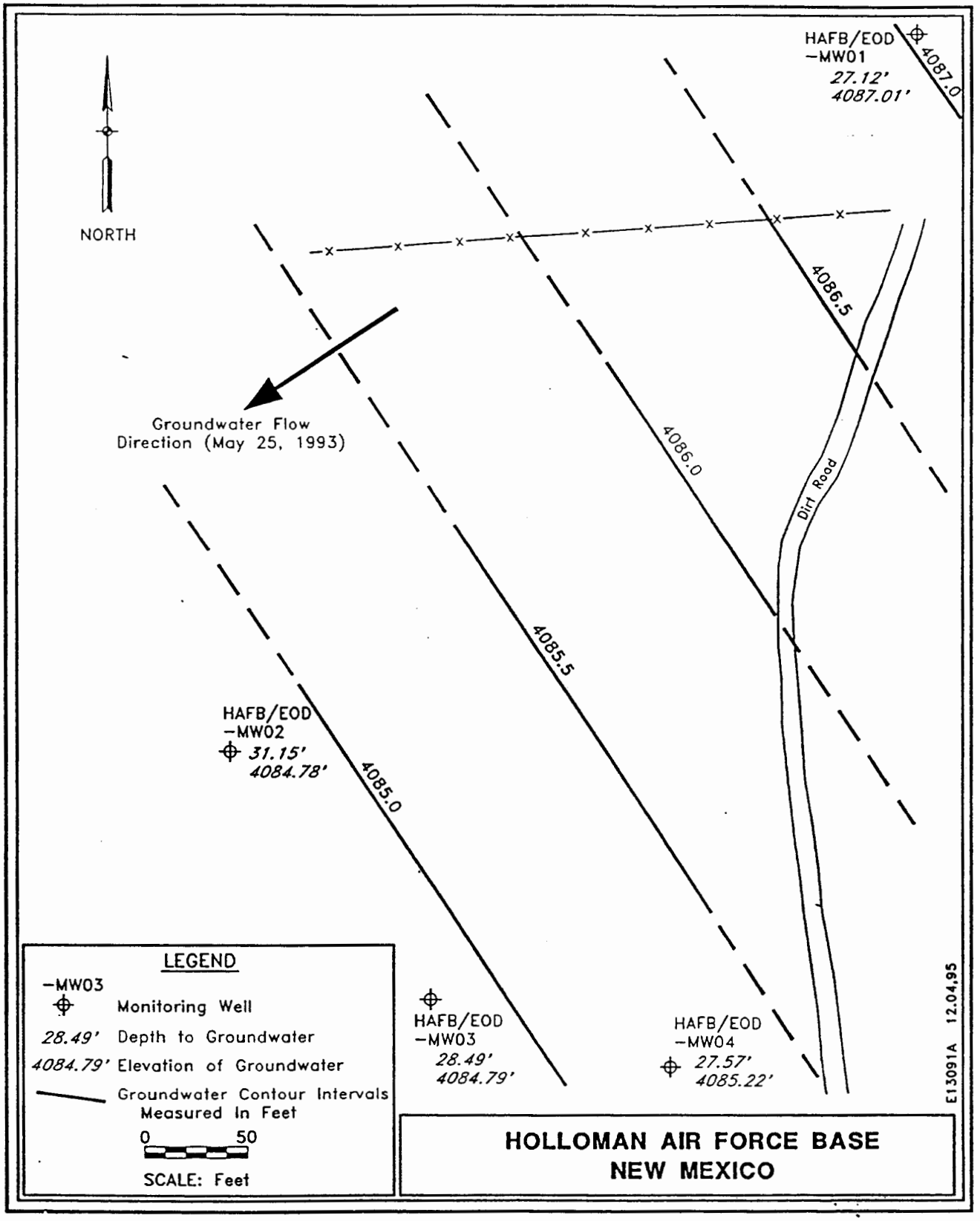


Figure K-1 Potentiometric Groundwater Surface Map at the OD Unit (after Labat-Anderson, 1993)

Proximity to Groundwater Withdrawal Points

No water supply wells are located on Holloman AFB because of the poor water quality. Base potable water supplies are obtained from Bonita Lake and from 21 wells in three separate well fields (Boles, San Andres, and Douglas) located on the western slope of the Sacramento Mountains approximately 10 miles east of Holloman AFB. Production wells in that area intercept groundwater at depths ranging from 250 to 300 feet BGS. The nearest production well downgradient of Holloman AFB is a livestock well located approximately 3.5 miles southwest of the Base. No other downgradient or near-Base potable or irrigation wells exist.

Other chief water users in the Tularosa Basin include the city of Alamogordo and White Sands Missile Range Headquarters. The city of Alamogordo obtains its water from several sources including: Lake Bonita, 60 miles northeast of the basin; developed springs in La Luz, Alamo, and Fresnal Canyons in the Sacramento Mountains; and from wells drilled in alluvial fan deposits at the base of the Sacramento Mountains between Alamogordo and La Luz (located more than 10 miles southeast of the OD Unit). White Sands Missile Range obtains its fresh water supply from alluvial deposits between the Organ and San Andres Mountains, and along the mountain front on the west side of the basin.

It is extremely unlikely that the water in the uppermost saturated zone beneath the OD Unit would ever be used for drinking water, domestic purposes, or irrigation.

Proximity to Surface Waters

Surface water resources within the Tularosa Basin are limited by the high evapotranspiration rate and low annual rainfall. The majority of surface water in the basin is either lost to evaporation, transpiration, and infiltration or collects in the lowest point in the basin at or near Lake Lucero, located at the southwest edge of the gypsum dune field approximately 30 miles southwest of the OD Unit. There are no surface water resources in the vicinity of the OD Unit.

PERMIT ATTACHMENT L

RECORDKEEPING

Operating Record:

Holloman U.S. Air Force Base will keep a written open detonation operating record of OD activities at the EOD Office at HAFB. The following records will be maintained at the EOD Office at HAFB:

- A description and the quantity of each hazardous waste received listed in Tables A-2 through A-6, Permit Attachment A, Waste Analysis Plan;
- Operating log that describes the type and quantity of hazardous waste treated in the OD treatment unit and the date the waste was detonated;
- Records and results of waste analyses performed as specified in 20 NMAC 4.1, Subpart V, §264;
- Reports of any incidents that required the activation of the contingency plan;
- Inspection logs for the last three years;
- Records of monitoring, testing, analytical data, and any corrective actions taken to prevent or mitigate releases of hazardous waste to the environment;
- Training records for explosive ordnance disposal (EOD) personnel;
- Disposal requests and Land Disposal Restriction Certifications for hazardous waste transported to a permitted facility;
- Correspondence and other documents from governmental agencies that affect the OD treatment unit.

Additional Reports:

In compliance with 20 NMAC 4,1, Subpart V, Pt. V, §264.56(j), and Subpart, VI, §265.56(j), any release, fire, explosion, or other unusual occurrence that results in implementation of the contingency plan will be noted in the OD treatment unit operating record and reported in writing within 15 days to the Secretary.

Biennial Report:

In accordance with 20 NMAC 4.1, Subpart V, §264.75, a biennial report on OD treatment activities will be prepared and submitted to the Secretary of the NMED. The report will be prepared and submitted to cover facility activities at the OD treatment unit during the previous calendar year. The EPA identification number, name, and address of the facility will be included in the report. A description and the quantity of each RCRA-regulated explosive hazardous wastes treated at the OD unit will be listed. The method of treatment and disposal for each RCRA-regulated explosive hazardous waste will be described.

PERMIT ATTACHMENT M

AIR EMISSIONS AND AIR QUALITY ASSESSMENT

This section presents air quality assessments and the findings from air modeling that was conducted using the Air Model "**INPUFF**". The results of the modeling indicate that there will be no release of above background concentrations of hazardous constituents into the environmental media at the Holloman air Force Base (**HAFB**) Open Detonation (**OD**) Treatment unit.

REDUCTION OR PREVENTION OF EMISSIONS

There are no structures or control systems designed to prevent or reduce emissions of hazardous constituents to the air.

OPERATING CHARACTERISTICS

The OD Unit at HAFB is currently operated on an intermittent basis for treatment of waste energetic hazardous wastes items. Nearly all of the energetic wastes are transformed into gaseous or particulate form. The time required for the detonation process consists of two components which include the following:

- waste placement and stacking (1 to 8 hours),
- detonation inspection (1 hour)

The emissions associated with the process are nearly instantaneous due to the nature of the treatment process. Total emissions and analysis of potential receptor exposures are presented for typical treatment cases below under the paragraph titled "Asessment of Migration Potential".

ATMOSPHERIC, METEOROLOGICAL, AND TOPOGRAPHIC CHARACTERISTICS

The 20,000 OD Unit at Holloman AFB is situated on flat terrain. There are no complex topographic features in the vicinity. The meteorologic conditions on-site are summarized in Table G-1, permit Attachment G. Additionally, wind roses for the last five years are contained in Appendix G, Permit Attachment G.

EXISTING AIR QUALITY

Otero County, New Mexico, where the subject OD unit is located is identified as an attainment area for all National Ambient Air Quality Standards (**NAAQS**). Holloman AFB is in compliance with all applicable NAAQS. Holloman AFB is a major source under Titles III and V of the Clean Air Act Amendments, as well as a

Titles III and V of the Clean Air Act Amendments, as well as a major source in terms of Prevention of Significant Deterioration (**PSD**) requirements. The Base has submitted all appropriate permit applications for these regulations, and is in compliance with all requirements. Table M-1 summarizes the state and federal NAAQS, PSD, Title III, and Title V levels.

ASSESSMENT OF AIR MIGRATION POTENTIAL

Holloman Air Force Base treats various hazardous wastes through open detonation at their 20,000-Pound OD unit. The 20,000-Pound OD Unit is located to the north-northeast of the high speed test track within the northern portion of Holloman AFB and is about 2600 feet (800 meters) from the nearest property location. The following modeling analysis assumes that the maximum annual detonation mass is 50,000 pounds net explosive weight (NEW) and the maximum single detonation mass is 20,000 pounds NEW. An air quality analysis was performed to determine the ambient impacts on nearby receptors due to the 20,000-Pound OD unit.

Since the open detonation activities are short-duration events, the air quality analysis conducted used the INPUFF model. This air dispersion model is available through the EPA's UNAMAP system. INPUFF is designed to estimate concentrations from semi-instantaneous point sources.

The 20,000-Pound OD unit emissions were estimated based on emission factors derived by the U.S. Army Armament, Munitions and Chemical Command *(Development of Methodology and Technology for Identifying and Quantifying Emission Products from Open Burning and Open Detonation Thermal Treatment Methods)*, and from EPA's *Compilation of Air Pollution Emission Factors* (AP-42). The U.S. Army tests were conducted during field tests conducted between 1988 and 1990 at the Dugway Proving Ground in Utah.

The air quality assessment presents in the following information:

- Description of the INPUFF model;
- Modeling methodology;
- Source parameters;
- Emission factors and rates; and,
- Dispersion modeling results.

The 20,000-Pound OD unit modeled impacts were compared to the New Mexico and the National Ambient Air Quality Standards (**AAQS**). Furthermore, Toxic Air Pollutants (**TAPs**) impacts were compared to the New Mexico Air Quality Control Regulations (**AQCR**) 702 limits, which are defined as 1/100 of the Occupational Exposure Limit (**OEL**).

Table M-1 displays the emission factors, AAQS, and the results of the INPUFF modeling for each pollutant. All pollutant impacts are within compliance of the air quality standards.

Table M-1

Air Quality Standards, Emission Factors and Modeled Impacts for the 20,000-Pound OD Unit

Compound	Averaging Period	Emission Factor (lb/lb)	AAQS or 1/100 OEL ($\mu g/m^3$)	Modeled Impact ($\mu g/m^3$)	Reference
CRITERIA POLLUTANTS					
Carbon Monoxide	1-Hour 8-Hour	0.472	12,480 8,285	150 18.7	2
Lead	3-month	6.0E-04	1.5	2.21E-04	2
Nitrogen Dioxide	24-Hour Annual	0.0595	156 78.0	0.787 0.00539	2
PM_{10}	24-Hour Annual	0.760	150 50	10.1 0.0689	3
Sulfur Dioxide	3-Hour 24-Hour Annual	0.00800	1,300 218 43.5	0.847 0.106 7.25E-04	2
HAZARDOUS AIR POLLUTANTS					
1,3-Butadiene	8-Hour	4.17E-05	200	1.66E-03	1
1,4-Dichlorobenzene	8-Hour	3.15E-07	3000	1.25E-05	1
2,4-Dinitrotoluene	8-Hour	8.40E-06	15	3.33E-04	1
4-Nitrophenol	8-Hour	2.59E-06	---	1.03E-04	1
Acetophenone	8-Hour	1.50E-05	---	5.95E-04	1
Antimony	8-Hour	1.06E-06	5	4.21E-05	1
Arsenic	8-Hour	2.23E-05	---	8.85E-04	1
Benzene	8-Hour	1.10E-04	---	4.37E-03	1
Biphenyl	8-Hour	5.20E-08	15	2.06E-06	1
Bis(2-ethylhexyl) phthalate	8-Hour	3.61E-06	---	1.43E-04	1
Cadmium	8-Hour	2.86E-06	0.5	1.14E-04	1
Carbon Tetrachloride	8-Hour	6.30E-06	300	2.50E-04	1
Chromium	8-Hour	3.52E-06	5	1.40E-04	1
Dibenzofuran	8-Hour	1.32E-06	---	5.24E-05	1
Hydrogen Cyanide	8-Hour	0.0160	100	0.635	2
Mercury	8-Hour	1.64E-07	---	6.51E-06	1
Naphthalene	8-Hour	1.50E-04	500	5.95E-03	1
Nickel	8-Hour	2.54E-06	10	1.01E-04	1
Phenol	8-Hour	2.52E-05	190	1.00E-03	1
Vinyl Chloride	8-Hour	1.23E-06	---	4.88E-05	1

1 Development of Methodology and Technology for Identifying and Quantifying Emission Products from Open Burning and Open Detonation Thermal Treatment Methods, Bang Box Test Series. Headquarters US Army Armaments, Munitions, and Chemical Command. Volume I, 1992.

2 US Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 1993.

3 Air Quality Modeling Report for the Kirtland Air Force Base Open Burning/Open Detonation Facility, Radian, Sept, 1995.

DESCRIPTION OF THE INPUFF MODEL

INPUFF is a Gaussian-integrated puff model used to model either semi-instantaneous releases or the more typical continuous plume emitted from a stack, over a spatially and temporally variable wind speed. The puff model is usually employed when the release interval of the plume cloud is less than the travel time of the cloud to the receptor. The algorithm assumes a vertically uniform wind direction field and no chemical reactions. Dispersion is assumed in the z, y, and downwind (x) directions. Puffs are assumed to be circular with the highest concentration in the center of the plume. The release puff is then transported by wind, growing in size as it entrains ambient air. The mass of the gas in the cloud does not change as the cloud moves downwind, but its concentration decreases as more ambient air is entrained.

The meteorological inputs to the model include wind speed, wind direction, ambient temperature, mixing height, stability class and anemometer height. Source inputs to the model include location, emission rate, release height, exhaust temperature, stack gas volume, initial dispersion parameters, and gravitational and deposition settling velocities.

The average puff concentration is a function of wind speed and the distance of the receptor from the initial puff release location. At long downwind distances and high wind speeds, the average concentration will be significantly lower than the peak instantaneous concentrations; this occurs because the puff has become diluted. At shorter distances and lower wind speeds, the peak instantaneous concentrations will be about the same as the average concentration.

INPUFF (Version 2.3), an EPA approved model, was used in the 20,000-Pound OD unit modeling exercise.

The following model options were used in INPUFF:

- The Pasquill-Gifford (P-G) model option was used to determine downwind dispersion. The P-G dispersion scheme is a function of downwind distance and stability class.

- The buoyancy-induced dispersion option was used. Plume rise was calculated considering both momentum and buoyancy.
- The stack tip downwind option was used. A height increment was deducted from the physical stack height before momentum or buoyancy rise was determined. This option affects sources with small ratios of exit velocity to wind speed, similar to the open detonation.
- The puff combination option was used. Puffs are combined when their centers are within one lateral standard deviation of each other.
- The settling and dry deposition velocities were set to zero. Using a zero settling velocity gives a conservative estimate of concentrations, since particulate settling is not taken into account.

METEOROLOGICAL AND SOURCE PARAMETERS

The following meteorological inputs were used based on conditions in El Paso, Texas, which is located 75 miles south-southwest of HAFB. Table M-2 displays significant meteorological data.

- A mixing height of 2,610 meters, the average mixing height at El Paso, was used.
- A very large value for the transition to long travel time dispersion was selected (25,000 meters). If the puff had attained a horizontal dimension of 25,000 meters, the model would have switched to the long travel time dispersion when puff growth rate is proportional to the square root of time. The 25,000 meters value was conservatively chosen so that the long time code algorithm would not be executed.
- A wind direction was chosen so that all target receptors were directly downwind, giving a conservative value for downwind concentrations.
- Stability classes, A through D (1 through 4) were used in the modeling exercise. The E and F (5 and 6) stability classes were not used since all 20,000-Pound OD unit activities take place only during daylight hours. E and F rarely occur during the day.
- The climate for El Paso, Texas is characterized by an annual minimum daily temperature of 49°F, an annual

daily maximum of 78°F, and an annual average of 63.0°F. The annual mean wind speed is 8.8 miles per hour.

All the above meteorological data was acquired from the Comparative Climatic Data for the United States through 1992.

Ambient concentrations from the 20,000-Pound OD unit were calculated for a number of receptors located beyond the open detonation area. The first receptor was placed at the nearest property line location, 800 meters downwind. Subsequent receptors were placed at 100 meter intervals to 1 kilometer from the 20,000-Pound OD Unit, at 1 km intervals to 10 km beyond the unit, and 5 km intervals to 25 km beyond the unit. The nearby terrain is flat, with hills and mountains about 6 km to the east.

A unit emission rate of 1,000 grams(g)/second was used in the modeling analysis. The modeled concentrations resulting from the unit emission were scaled to reflect actual emission rates. An emission release height of 1.0 meter was chosen. This modeling analysis assumed that the open detonation is conducted in a circular area with a diameter of 30 feet (9.14 meters). A release flowrate was calculated based on the stoichiometry and the duration of the detonation (300 seconds) event. Initial plume dispersion parameters (sigma z and sigma y) were conservatively set equal to zero. This is a conservative approach, which yields higher air contaminant concentrations at the receptors.

The release temperature was calculated using an adiabatic flame temperature. Tests show that open detonation activities are extremely efficient processes when carbon is converted to CO_2. For surface detonations, all but six percent of the carbon in TNT is converted to CO_2 and most of the remaining is CO. The release temperature was based on the conversion of carbon to CO_2 in the presence of 50 percent excess air. Some quenching effort due to soil may take place during OD activities, but the magnitude of this effect is not clear. A flame temperature of 2,800°F was selected for the 20,000-Pound OD unit modeling exercise. This flame temperature correlates well with combustion temperatures of between 1,800°F and 3,000°F reported in other OD studies (El Dorado Engineering, 1991).

For the OD activities, which are instantaneous, burn times are not relevant. However, INPUFF requires the input rate variable inputs such as flowrate and velocity. Therefore, a "burn time" of five minutes was chosen for 20,000-Pound OD unit activities. The blast is instantaneous; however, the detonation burn may take a few minutes to subside.

The volumetric flow rate is based on stoichiometry considering no excess air. This is conservative since the smaller the volumetric flowrate, the higher the concentration at the receptors. The mass of OD unit materials is limited to 20,000 pounds per event. Considering the OD unit material to consist mainly of carbon, the volumetric flowrate was calculated as follows:

$$C + O_2 \rightarrow CO_2$$

$$12\ lbs\ C + 32\ lbs\ O_2 \rightarrow 44\ lbs\ CO_2$$

$$20{,}000\ lbs\ C \rightarrow 20{,}000 \times \frac{44\ lbs\ CO_2}{12\ lbs\ C}$$

$$= 73{,}333\ lbs\ of\ CO_2$$

$$= 1{,}667\ lb\ moles\ CO_2$$

1 lb mole of an ideal gas occupies 2,379 ft^3 @ 14.7 psi and 2,800°C

Therefore, 1,667 lbs moles of CO_2 would occupy:

$$= 1{,}667 \times 2{,}379\ ft^3$$

$$= 3{,}965{,}793\ ft^3$$

Volumetric flow rate $= 3{,}965{,}793\ ft^3/300\ sec$

$$= 13{,}219\ ft^3/sec$$

$$= 374\ m^3/sec$$

The release velocities were calculated from the volumetric flow rate and the release diameter:

Release velocity $= 74\ m^3/sec\ /\ 65.6\ m^2$

$$= 5.70\ m/sec$$

EMISSION FACTORS AND RATES

The emission calculations presented in this section are based on emission factors developed as a result of two types of emission tests conducted in New Mexico and Utah by the Headquarters, U.S. Army Armament, Munitions, and Chemicals Command from 1988 through 1990. The first series of tests involved trinitrotoluene (**TNT**) detonations and propellant burns characterized in a Bang Box (**BB**) chamber during December 1988 and January 1989.

The BB test facility was used to determine emission factors for volatile organic (VOCs), semivolatiles, nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), sulfur dioxide (SO_2),

ozone, organic particulate, metals, ammonia (NH_3), hydrogen cyanide (HCN), and hydrogen chloride (HCl). The materials tested inside the Bang Box were TNT, a double-base propellant containing primarily nitrocellulose, and nitroglycerin with added ethyl cellulose and a composite propellant containing ammonium perchlorate.

The U.S. Army's second series of field tests occurred in 1989 and 1990. The test included the open burning of M30 (triple-base propellant), BM6 (M6 propellant), BM1 (M1 propellant), and BMR (propellant manufacturing residue). Open detonation included the detonation of TNT, CMB (Composition B), EXD (explosives D), and RDX (cyclotrimethylene trinitramine). The type of OD materials detonated during these tests were either the same or similar to the type of materials detonated. Open detonation was conducted by either suspending the explosive above ground or by surface detonation. Combination products were analyzed from: 1) soil samples, 2) blast material deposited on pans placed at various distances from the source, and 3) samplers mounted on aircraft. For the emissions factors used in this application, the worst-case (highest) factor was selected for each compound from all BB tests, field tests, and the EPA's AP-42 document. Table M-1 displays the emission factors which were used for this analysis.

Particulate concentrations during the field tests were determined by taking soil samples and expressing the concentrations as grams per gram of soil. No emission factors relating particulate matter debris to the quantity of material detonated were available. During surface detonation, the component of the blast wave is propagated parallel to the ground stirring up a dust cloud into the atmosphere and extending radially out from the center. Particulate emissions vary due to influences of soil moisture and composition. A large portion of the displaced ejected soil (ejecta) are redeposited in the resulting crater/depression or within a few meters of the crater.

The following discussion concerns the estimation of particulate emissions due to the ejecta. The typical depression produced from a 20,000 pounds NEW detonation was estimated to be a conical depression, 5 feet deep and 30 feet wide. This represents a volume of 1178 cubic feet (33.4 cubic meters). Assuming a soil density (for desert sand) of 1,330 kilograms per cubic meter, each detonation results in 44,370 kilograms of soil removed. The majority of this soil deposits on the ground near the detonation site (within a 150 foot radius). For the purpose of estimating particulate matter (**PM_{10}**) emissions, it has been assumed that 1% of the volume of the crater is emitted into the atmosphere as particulate. This results in a maximum PM emission rate of 444

kilograms per event (0.05 lb/lb charge). A PM emission factor of 0.71 lb/lb of charge was observed in RDX surface detonation by the Air Force in 1994. Combining the PM emissions from the combustion and the indirect activities (ejecta) yields a maximum total PM emission factor of 0.76 lb/lb charge. This is a very conservative value. All particles are considered to be PM_{10} particles. This emission factor was used to calculate particulate emissions for the 20,000-Pound OD unit.

DISPERSION MODELING RESULTS

The INPUFF ambient impacts were simulated for the 8-hour averaging period. Since the release periods for 20,000-Pound OD Unit events are short compared to the averaging periods, the 24-hour averaging period concentrations were determined to be 1/3 the 8-hour concentrations. Similarly, the 1-hour averaging concentrations were determined by multiplying the 8-hour concentrations by eight. Other averaging periods were calculated in the same manner. The modeling was completed for stability classes A through D since the 20,000-Pound OD Unit activities only take place during daylight hours and stability classes E and F normally occur during nighttime. Wind speeds between 1 m/s (calm winds) and 20 m/s were used. The modeled results show that the ambient concentrations for criteria pollutants are below all the ambient air quality standards . Table M-2 shows the maximum 8-hour unit impacts (based on 1,000 grams/second) at each receptor. The unit impacts should be multiplied by the emission factor and adjusted to the particular averaging period for comparison to the ambient air quality standards. The results show that most receptors are impacted greatest during low wind speed and very stable atmospheric conditions.

Pollutant: CO Burn time: 300 seconds
Maximum emission factor: 0.472 lbs/lb of charge

$$\text{Emission rate of CO} = \frac{0.472 \text{ lb}}{\text{lb of charge}} \times 20{,}000 \text{ lbs of charge}$$

= 9,440 lbs of CO in 300 seconds (4,280,100 g)
= 14,270 g/s

Ambient concentration for an emission rate of 1,000 g/sec:

8-hour averaging period concentration = 1.31 $\mu g/m^3$
1-hour averaging period concentration = 10.5 $\mu g/m^3$
24-hour averaging period concentration = 0.434 $\mu g/m^3$
Annual averaging period concentration = 0.003 $\mu g/m^3$

Maximum 1-hour off-site CO concentration due to open detonation of 20,000 lbs:

$$= \frac{14{,}270 \text{ g/sec}}{1{,}000 \text{ g/sec}} \times 10.5\ \mu g/m^3$$

$$= 155\ \mu g/m^3$$

Maximum 8-hour off-site CO concentration due to open detonation of 20,000 lbs:

$$= \frac{14{,}270 \text{ g/sec}}{1{,}000 \text{ g/sec}} \times 1.31\ \mu g/m^3$$

$$= 18.7\ \mu g/m^3$$

Maximum NEW detonated per year = 240,000 lbs

Number of events required to burn 240,000 lbs at 20,000 lbs per event

$$= \frac{240{,}000 \text{ lbs/year}}{20{,}000 \text{ lbs/event}}$$

$$= 12 \text{ events per year}$$

Maximum annual off-site concentration of CO:

$$= \frac{14{,}270 \text{ g/sec} \times 0.437\ \mu g/m^3 \times 12 \text{ events/year} \times 1 \text{ year}}{1{,}000 \text{ g/sec} \times 365 \text{ days}}$$

$$= 0.205\ \mu g/m^3$$

The air quality assessment of 20,000-Pound OD Unit activities consisted of a description of the INPUFF model, modeling methodology, source parameters, emission factors and rates and the dispersion modeling results. The dispersion modeling results show that the 20,000-Pound OD Unit operations are within compliance with the AAQS for the criteria pollutants. Toxic air pollutant impacts are all below the 1/100 OEL limits in AQCR 702.

Table M-2
Maximum Modeled Unit Emission Concentrations[a]
from 20,000-Pound OD Unit Activities

Receptor Distance (km)	Wind Speed (m/s)	Stability Class	Maximum 8-Hour Concentration ($\mu g/m^3$)
0.5	1.0	1	0.101
0.6	3.0	1	0.204
0.7	3.0	1	0.367
0.8	3.0	1	0.587
0.9	3.0	1	0.848
1.0	3.0	1	1.12
2.0	2.0	1	1.11
3.0	1.0	1	1.31
4.0	1.0	1	1.31
5.0	20.0	4	1.25
10.0	1.0	1	0.736
15.0	1.0	1	0.544
20.0	1.0	2	0.553
25.0	1.0	2	0.464

[a] Based on a unit emission rate of 1,000 g/s.

PERMIT ATTACHMENT N

PERMITTED WASTE CODES

EPA PERMIT APPLICATION

PART A

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

For EPA Regional Use Only

Date Received
Month Day Year

EPA
United States Environmental Protection Agency
Washington, DC 20460

Hazardous Waste Permit Application Part A

(Read the instructions before starting)

I. Installation's EPA ID Number *(Mark "X" in the appropriate box)*

[ ] A. First Part A Submission

[X] B. Part A Amendment # 11

C. Installation's EPA ID Number: N M 6 5 7 2 1 2 4 4 2 2

D. Secondary ID Number *(If applicable)*:

II. Name of Facility: HOLLOMAN AIR FORCE BASE

III. Facility Location *(Physical address not P.O. Box or Route Number)*

A. Street: 550 TABOSA AVE

Street *(Continued)*: 49 CES/CEV

City or Town: HOLLOMAN AFB

State: NM

Zip Code: 88330-8458

County Code *(If known)*:

County Name: OTERO

B. Land Type (Enter code): F

C. Geographic Location
LATITUDE (Degrees, Minutes, & Seconds): 33 01 02 2
LONGITUDE (Degrees, Minutes & Seconds): 106 09 05 8

D. Facility Existence Date
Month Day Year: 02 28 1981

IV. Facility Mailing Address

Street or P.O. Box: SAME

City or Town:

State:

Zip Code:

V. Facility Contact *(Person to be contacted regarding waste activities at facility)*

Name *(Last)*: POLAND

(First): JOHN

Job Title: CH ENV FLIGHT

Phone Number *(Area Code and Number)*: 505-475-3931

VI. Facility Contact Address *(See instructions)*

A. Contact Address
Location [X] Mailing [ ] Other [ ]

B. Street or P.O. Box:

City or Town:

State:

Zip Code:

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Form Approved, OMB No. 2050-0034 Expires: 9-30-96
GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1)	Secondary ID Number (Enter from page 1)
NM6572124422	

VII. Operator Information (See instructions)

Name of Operator
Lt Col Henkel BASE CIVIL ENG

Street or P.O. Box
550 TABOSA AVE 49 CES/CEV

City or Town	State	ZIP Code
HOLLOMAN AFB	NM	88330-8458

Phone Number (Area Code and Number)	B. Operator Type	C. Change of Operator Indicator	Date Changed (Month Day Year)
505-475-3071	F	Yes X No	100995

VIII. Facility Owner (See instructions)

A. Name of Facility's Legal Owner
BRIG GEN CARLSON WING COMMANDE

Street or P.O. Box
490 FIRST STREET Ste 1700

City or Town	State	ZIP Code
HOLLOMAN AFB	NM	88330-8277

Phone Number (Area Code and Number)	B. Owner Type	C. Change of Owner Indicator	Date Changed (Month Day Year)
505-475-5571	F	Yes X No	100995

IX. SIC Codes (4-digit, in order of significance)

Primary		Secondary	
9711	(Description) National Security		(Description)
Secondary		**Secondary**	
	(Description)		(Description)

X. Other Environmental Permits (See instructions)

A. Permit Type (Enter code)	B. Permit Number	C. Description
P	291/291M1	Bulk storage tanks/ Air Bureau
R	NM6572124422-1	TSDF/DRMO

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GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1)												Secondary ID Number (Enter from page 1)											
N	M	6	5	7	2	1	2	4	4	2	2												

XI. Nature of Business (Provide a brief description)

The base is headquarters to the Air Combat Command 49th Fighter Wing. Supports national security objectives with F-117 Stealth fighters, HH-60 helicopters, medical, and war readiness assets. Rapidly mobilize and deploy worldwide to meet peacetime and wartime contingencies. Supports over 19000 personnel. The base supports several, tenants, contractors, and others. As a result of the above stated organizations and their activities, certain processes require the open detonation of waste munitions.

XII. Process Codes and Design Capacities

A. PROCESS CODE - *Enter the code from the list of process codes below that best describes each process to be used at the facility. Thirteen lines are provided for entering codes. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), describe the process (including its design capacity) in the space provided in item XIII.*

B. PROCESS DESIGN CAPACITY - *For each code entered in column A, enter the capacity of the process.*

1. AMOUNT - *Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.*
2. UNIT OF MEASURE - *For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.*

C. PROCESS TOTAL NUMBER OF UNITS - *Enter the total number of units used with the corresponding process code.*

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
	Disposal:	
D79	Underground Injection	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	Landfill	Acre-feet or Hectare-meter
D81	Land Treatment	Acres or Hectares
D82	Ocean Disposal	Gallons Per Day r Liters Per Day
D83	Surface Impoundment	Gallons or Liters
D99	Other Disposal	Any Unit of Measure Listed Below
	Storage:	
S01	Container (Barrel, Drum, Etc.)	Gallons or Liters
S02	Tank	Gallons or Liters
S03	Waste Pile	Cubic Yards or Cubic Meters
S04	Surface Impoundment	Gallons or Liters
S05	Drip Pad	Gallons or Liters
S06	Containment Building-Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure Listed Below
	Treatment:	
T01	Tank	Gallons Per Day or Liters Per Day
T02	Surface Impoundment	Gallons Per Day or Liters Per Day
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; or Btu's Per Hour
T04	Other Treatment	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or Btu's Per Hour
T80	Boiler	Gallons or Liters
T81	Cement Kiln	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or Btu's Per Hour
T82	Lime Kiln	
T83	Aggregate Kiln	
T84	Phosphate Kiln	
T85	Coke Oven	
T86	Blast Furnace	
T87	Smelting, Melting, Or Refining Furnace	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or Btu's Per Hour
T88	Titanium Dioxide Chloride Process Oxidation Reactor	
T89	Methane Reforming Furnace	
T90	Pulping Liquor Recovery Furnace	
T91	Combustion Device Used In The Recovery Of Sulfur Values From Spent Sulfuric Acid	
T92	Halogen Acid Furnaces	
T93	Other Industrial Furnaces Listed In 40 CFR §260.10	
T94	Containment Building-Treatment	Cubic Yards or Cubic Meters
	Miscellaneous (Subpart X):	
X01	Open Burning/Open Detonation	Any Unit of Measure Listed Below
X02	Mechanical Processing	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; or Kilograms Per Hour
X03	Thermal Unit	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or Btu's Per Hour
X04	Geologic Repository	Cubic Yards or Cubic Meters
X99	Other Subpart X	Any Unit of Measure Listed Below

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
Gallons	G	Short Tons Per Hour	D	Cubic Yards	Y
Gallons Per Hour	E	Metric Tons Per Hour	W	Cubic Meters	C
Gallons Per Day	U	Short Tons Per Day	N	Acres	B
Liters	L	Metric Tons Per Day	S	Acre-feet	A
Liters Per Hour	H	Pounds Per Hour	J	Hectares	Q
Liters Per Day	V	Kilograms Per Hour	R	Hectare-meter	F
				Btu's Per Hour	I

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GSA No. 0248-EPA-OT

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N M 6 5 7 2 1 2 4 4 2 2	

XII. Process Codes and Design Capabilities (Continued)

EXAMPLE FOR COMPLETING ITEM XII (Shown in line number X-1 below): A facility has a storage tank, which can hold 533.788 gallons.

Line Number	A. Process Code (From list above)	B. PROCESS DESIGN CAPACITY 1. Amount (Specify)	2. Unit Of Measure (Enter code)	C. Process Total Number Of Units	For Official Use Only
X 1	S 0 2	5 3 3 7 8 8	G	0 0 1	
1	X 0 1	1 0.0 0 0	N	0 0 1	
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

NOTE: If you need to list more than 13 process codes, attach an additional sheet(s) with the information in the same format as above. Number the lines sequentially, taking into account any lines that will be used for "other" processes (i.e., D99, S99, T04 and X99) in Item XIII.

XIII. Other Processes (Follow instructions from Item XII for D99, S99, T04 and X99 process codes)

Line Number (Enter as in seq. w/XII)	A. Process Code (From list above)	B. PROCESS DESIGN CAPACITY 1. Amount (Specify)	2. Unit Of Measure (Enter code)	C. Process Total Number Of Units	D. Description Of Process
X 1	T 0 4				In-situ Vitrification
12					
2					
3					
4					

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GSA No. 0248-EPA-O

EPA I.D. Number (Enter from page 1)												Secondary ID Number (Enter from page 1)
N	M	6	5	7	2	1	2	4	4	2	2	

XIV. Description of Hazardous Wastes (Continued)

Line Number	A. EPA HAZARDOUS WASTE NO. (Enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter code)									(2) PROCESS DESCRIPTION (If a code is not entered in D(1))
1	D	0	0	3	450000	P	X	0	1							
2																
3																
4																
5																
6																
7																
8																
9																
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Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

EPA I.D. Number (Enter from page 1)	Secondary ID Number (Enter from page 1)
N M 6 5 7 2 1 2 4 4 2 2	

XIV. Description of Hazardous Wastes

A. EPA HAZARDOUS WASTE NUMBER: Enter the four digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four digit number(s) from 40 CFR, Part 261 Subpart C that apply to the characteristics of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY: For each hazardous waste listed in column A, estimate the quantity of that waste that will be stored, treated, or disposed at the facility on an annual basis. For hazardous wastes generated at more than one process, estimate the total annual quantity of that waste that will be stored, treated, or disposed at the facility.

C. UNIT OF MEASURE: Enter the proper code for the unit of measure which must be used in the following manner:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

D. PROCESS

(1) PROCESS CODES

(2) PROCESS DESCRIPTION

EXAMPLE FOR COMPLETING ITEM XIV (shown in line numbers X, 1, 2, X, 3, and X, 4 below): A facility will treat and dispose of an estimated 200 pounds per year of corrosive wastings from leather tanning and finishing operations. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

Line Number	A. EPA HAZARD WASTE NO. (Enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (Enter code)	D. PROCESS (1) PROCESS CODES (Enter code)	D. PROCESS (2) PROCESS DESCRIPTION (If a code is not entered in D(1))
X	K 0 0 4	300	P	T 0 3 D 8 0	
X 2	D 0 0 2	400	P	T 0 3 D 8 0	
X 3	D 0 0 1	100	P	T 0 3 D 8 0	
X 4	D 0 0 2				

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GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1)	Secondary ID Number (Enter from page 1)
N M 6 5 7 2 1 2 4 4 2 2	

XV. Map

Attach to this application a topographic map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in this map area. See instructions for precise requirements.

XVI. Facility Drawing

All existing facilities must include a scale drawing of the facility (see instructions for more detail).

XVII. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

XVIII. Certification(s)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner Signature	Date Signed 10 Nov 95
Name and Official Title (Type or print) BRUCE CARLSON, BRIGADIER GENERAL, USAF, COMMANDER	
Owner Signature	Date Signed 19 Oct 95
Name and Official Title (Type or print) ROBERT R. HENKEL, Lt Col, USAF, Base Civil Engineer	
Operator Signature	Date Signed
Name and Official Title (Type or print)	
Operator Signature	Date Signed
Name and Official Title (Type or print)	

XIX. Comments

Note: Mail completed form to the appropriate EPA Regional or State Office. (Refer to instructions for more information)

Table C.1-3

Sample Location Descriptions and Rationale

Strata	Strata Definition	Expected Distribution of Detonation Residuals	Sample Type/Location	Basis for Sampling Strategy	Number of Samples per Sampling Event
A	The depression left by the detonation, regardless of the size of the depression. Stratum includes the walls of the depression.	Stratum will include fallout from the most recent detonation. Soil and residuals will be substantially thicker in the detonation center than at outlying areas.	•4 discrete surface samples composited from a depth of 0 to 12-in. Each sample selected randomly from a pre-determined grid across the depression (that includes the sides).	Samples from the pit at the center of the detonation to assess levels of chemical residues. Twelve inches is the estimated thickness of fallout in the depression.	4
B	From the edge of the depression left by the detonation to the 100-ft diameter area where detonations occur.	Previous detonations may have occurred in this area. Soil will include fallout from the most recent detonation as well as homogenized surface soils from previous detonation events and grading. A moderately thick layer of fallout is expected due to the proximity to the detonation center.	•4 discrete near-surface samples composited from a depth of 0 to 2-ft. Each sample selected randomly from a pre-determined grid.	Composite samples collected to a depth of approximately 2 ft, compositing the entire interval. Samples are intended to gauge potential contamination from fallout and re-worked soil from grading activities and filled in pits.	4
C	100-ft detonation area to edge of the OD Unit.	No detonations occur in this area. Soil will reflect only a thin layer of fallout material.	•4 discrete surface samples from 0 to 2-in. Each sample selected randomly from a pre-determined grid.	Composite samples to detect residuals from fallout. Two inches is the maximum anticipated depth of fallout in this stratum.	4
				Total	12

SECTION I

CLOSURE PLAN, CONTINGENT POST-CLOSURE PLAN, AND FINANCIAL REQUIREMENTS

This section contains the closure plan, contingent post-closure plan, and financial assurance information for the 20,000 Pound OD Unit at Holloman AFB (EPA ID NM6572124422) and is submitted in accordance with the requirements of 40 CFR 264.110 through 264.115, 270.14(b)(13), and 270.14(b)(15) through (18). Holloman AFB will also remain in compliance with all closure conditions as stated in the NMHWMR-7, Parts V and IX, regulations. Where federal and state requirements differ, the more stringent requirement will be met.

The closure plan and post-closure plan record copies will be maintained on-Base by the Environmental Flight Chief at Holloman AFB, New Mexico, until closure and post-closure care is completed and certified by the permittee and signed by a licensed professional engineer. An additional copy of these plans will be available at the Alamogordo Public Library. These plans will be updated as necessary by issuing either page changes or new copies, as appropriate, to all plan addressees. All contact concerning these plans should be addressed to:

Environmental Flight Chief
49 CES/CEV
Holloman AFB, NM 88330
phone: (505) 475-3931

I-1 CLOSURE PLAN [NMHWMR-7, Parts V and IX; 40 CFR 264.112 and 270.14(b)(13)]

Holloman AFB, located near Alamogordo, New Mexico, is a RCRA permitted treatment, storage, and disposal (TSD) facility. As part of normal industrial operations,

the Base is involved in the management of solid and hazardous wastes. One element of these operations is the destruction of off-specification or out-dated munitions. This closure plan identifies the closure process to be employed at the site where these activities occur—Holloman AFB's 20,000-Pound OD Unit—at any point during the site's intended operating life or for closure at the end of the operating life. This plan will be modified and updated throughout the life of permit as needed.

I-1a Closure Performance Standard [40 CFR 264.111]

This closure plan is designed to ensure that the 20,000-Pound OD Unit will not require further maintenance and controls, will minimize and eliminate threats to human health and the environment, will prevent the escape of hazardous wastes, hazardous constituents, or waste decomposition products to soils, surface waters, groundwater or the atmosphere, and will comply with all relevant closure requirements. To achieve this standard, measures taken during the active life as well as those that will be conducted during closure have been formulated specifically to address these criteria, as specified in 40 CFR 264.111.

I-1a(1) Summary of Activities Conducted During Active Life

During the active life of the unit, the post-treatment residuals and soils are sampled annually to demonstrate treatment effectiveness and ensure that residuals are nonhazardous. During the interim period between treatment events, the unit is periodically graded and residuals in the unit remain covered to retard leachate formation and prevent wind dispersal. Quarterly, residuals and soils are sampled for characteristics of hazardous waste and suspected hazardous constituents, as specified in the Sampling and Analysis Plan (SAP) provided as Attachment C-1. The SAP documents all of the protocols used during active-life sampling events.

I-1a(2) Summary of Closure Activities

At the conclusion of the final treatment event, the site will be inspected and all debris will be removed. Following these activities, representative samples from across the entire 20,000-Pound OD Unit will be collected and analyzed (as described in Section I-1d and the SAP) to determine the residual concentrations of any toxic metals and explosive compounds (if any). These analytical results will be compared to background levels or, as described in Attachment C-1, risk-based criteria deemed to be protective of human health. If all levels are determined to be below background (for metals) or the analytical detection limits (for organics), the closure will be considered clean closure. If levels are detected in excess of background or detection limits but are below risk-based criteria, the closure will be considered a risk-based closure.

In the event that an area of the unit is determined to contain levels in excess of risk-based criteria, further action will be taken as necessary in coordination with NMED prior to completing closure, such as risk assessment, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. When all such activities have been completed (as required) and all samples show that the residual levels of contamination are below the risk-based criteria, all remaining closure and post-closure activities will be completed, including grading, decontamination, and closure certification. More detailed descriptions of the specific activities that will be conducted to ensure that the closure performance standard is met are presented in the following sections.

I-1b Partial and Final Closure Activities [40 CFR 264.112(a)(1) and (b)(4)]

The closure of the 20,000-Pound OD Unit is considered a partial closure, since the anticipated closure of this site will occur prior to closure of the rest of the Base.

I-1c Maximum Waste Inventory [40 CFR 264.112(b)(3)]

Operating practice precludes the storage of hazardous wastes at the 20,000-Pound OD Unit. For safety reasons, waste munitions are treated as received or as generated and no other wastes are stored at the site. During operation, the maximum amount of hazardous wastes treated during a single OD event at any time during the life of the facility is 20,000 pounds NEW of waste munitions. No waste munitions will be present at the site upon initiation of closure activities.

I-1d Inventory, Removal, Disposal, and Decontamination of Equipment [40 CFR 264.112(b)(4)]

As outlined in I-1a, the steps to achieve the closure standard include site reconnaissance, removal of scrap materials and debris, closure sampling and analysis, risk-based screening, corrective action (if needed), surface grading, decontamination, and closure certification. Appropriate personal protective equipment (PPE) will be worn during each of these steps. Each step is discussed in detail below.

I-1d(1)Site Reconnaissance

Following the final treatment event, the unit will be inspected to ensure that the planned closure approach can be implemented. The inspection will consist of a visual site inspection (VSI) to identify the location of any scrap materials, debris, or any other substances that may impede closure of the unit. All materials that need to be removed prior to proceeding with closure will be documented in a field inspection logbook.

I-1d(2)Removal of Scrap Materials and Debris

On the basis of the VSI, any identified scrap, debris, or other substance that could

impede closure of the unit will be removed and disposed of in accordance with applicable requirements. Because treatment renders waste munitions nonhazardous, and because hazardous wastes are not stored at the site, it is anticipated that scrap materials and debris will be non-hazardous and can be managed as specified in the provisions of RCRA Subtitle D (40 CFR 257).

I-1d(3)Closure Sampling and Analysis

Following the activities specified in I-1d(1) and (2), representative samples from the 20,000-Pound OD Unit will be collected and analyzed to determine the residual concentrations of any toxic metals and high explosive (HE) compounds. Because abundant data will have been gathered during prior annual sampling events, and because it is important to verify that the entire area of the OD Unit has been adequately sampled, a non-stratified sampling approach will be used. For example, a geostatistical approach may be used for determining the placement and numbers of samples for closure. This approach will account for the spacing of previous samples and identify areas where additional sampling will be required. Once sampling location have been determined, hand auger samples will be collected from the surface interval (0-1 ft) at each of these locations and sent to an approved laboratory for analysis. Analyses to be performed include:

- SW7041 (antimony);
- SW7060 (arsenic);
- SW7421 (lead);
- SW7471 (mercury);
- SW7740 (selenium);
- SW6010 (metals); and
- SW8330 (explosives).

Because no materials other than waste munitions are stored or treated at the site, no other analyses are required. A complete description of the sampling and analysis

protocol and rationale, including that to be followed during closure, is provided in the SAP.

I-1d(4)Background Comparison and Risk-Based Screening

Following sampling and analysis, the analytical results will be compared to background results, as described in Section 9.2 of Attachment C-1, and appropriate risk-based standards deemed to be protective of human health. In the event that a sample or area of the site is determined to contain levels in excess of these standards, NMED will be contacted to discuss further action prior to completing closure, such as risk assessment, confirmation sampling, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. When all such activities have been completed (as required) and all sample results show that the residual levels of contamination are below the risk-based criteria or are protective of human health and the environment, all remaining closure activities will be completed.

I-1d(5)Corrective Action

As mentioned in I-1d(4), if any sample or area is determined to contain contaminant concentrations in excess of the risk-based criteria, remaining closure activities will be postponed until the Base and NMED jointly decide on the appropriate corrective action. Possible corrective actions could include risk assessment, confirmation sampling, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. Any hazardous investigation-derived waste and/or remediation waste that is generated and exceeds the risk-based criteria will be stored at the Holloman AFB Defense Reutilization and Maintenance Organization (DRMO) facility prior to shipment to an authorized disposal facility using an authorized transporter.

I-1d(6)Surface Grading

Once all scrap materials and any other debris have been removed, and sampling results indicate that all remaining analytes are below health-based criteria, the unit will be graded to manage surface water infiltration and run-off while controlling erosion. Specifically, surface grading will reduce ponding and runoff velocities that can contribute to soil erosion, and will roughen and loosen soils to facilitate natural revegetation.

I-1d(7)Decontamination

Following all activities in I-1d(1) through I-1d(6), all equipment will be washed with detergent and triple rinsed with water. All PPE and rinsewater will be disposed of properly.

I-1d(8)Certification of Closure

Following the performance of all closure activities, a certification of closure will be submitted by registered mail to the NMED RCRA Program Manager and/or the EPA Regional Administrator no later than 60 days following completion of all closure activities. The specifications for this certification are detailed in Section I-1g of this closure plan.

I-1e Other Activities [40 CFR 264.112(b)(5)]

In addition to the closure activities specified in I-1d, other tasks will be performed to ensure that the closure activities satisfy the closure performance standard. These tasks include periodic regrading and maintenance to retard erosion and run-on/runoff, and continued posting and security measures. A complete discussion on these activities is included as part of the Post-Closure Plan for the 20,000-Pound Unit, Sections I-2b and I-2c. Groundwater monitoring will not be conducted and a waiver from this activity is being requested as part of this permit application (see Attachment D-1). A waiver from

the groundwater monitoring requirements is being requested because: 1) the unit does not receive or contain wastes containing free liquids; 2) there is no potential for migration of contaminants to the groundwater; 3) the total dissolved solids (TDS) levels in the local groundwater has led to NMED classification of the aquifer as unpotable; 4) the remote location of the unit results in no potential receptors for the groundwater; and 5) there is no risk associated with the use of groundwater since the resource is not used.

I-1f Schedule for Closure [40 CFR 261.113(b)]

As specified in 40 CFR 261.113(b), closure activities at the 20,000-Pound OD Unit will be completed within 180 days of treating the final volume of hazardous waste. No extension beyond the 180 days provided is being requested at this time; however, if it is determined that an extension is needed, this plan will be modified. Notification of intent to close will be submitted to the NMED RCRA Program Manager and the USEPA Regional Administrator. The anticipated date for the initiation of closure activities is 1 January 2050. Table I-1 presents an estimated closure schedule.

Table I-1

Estimated Closure Schedule for the 20,000-Pound OD Unit

Closure Activity	Closure Period (Days)
Receive and treat final volume of waste	-10 to 0
Closure begins	0
Perform site reconnaissance	0 to 5
Remove scrap	5-15
Soil Sampling and Analysis	15-50
Address any exceedences of standard (if any)	50-130
Grade	130-140
Decontaminate equipment	140-150
Prepare closure certification/post-closure documentation	150-180
Submit closure certification/post-closure documentation	180
NMED issues post-closure permit	180-235
Conduct post-closure care activities	235-2060

I-1g Certification of Closure [40 CFR 264.115]

Upon completion of all activities specified in I-1d, certification that the closure of the 20,000-Pound OD Unit was performed in accordance with the specifications in the approved closure plan will be submitted by registered mail to the NMED RCRA Program Manager and/or the EPA Regional Administrator no later than 60 days following completion of all closure activities. The certification will be signed by an authorized official of Holloman AFB and an independent registered professional engineer. Documentation supporting the independent professional engineer's certification will be furnished to the NMED RCRA Program Manager and/or the EPA Regional Administrator upon request.

I-2 CONTINGENT POST-CLOSURE PLAN [NMHWMR-7, Parts V and IX; 40 CFR 264.117, 264.118, and 264.602]

Because some residues may remain in place, this contingent post-closure plan provides a description of the activities that may be conducted to ensure long-term reliability and effectiveness of the closure. This section is based on the general requirements of 40 CFR 264.117, 264.118, 264.602, and 264.603.

I-2a Post-Closure Care and Use of Property [40 CFR 264.117]

The following subsections describe the post-closure care period, site security during the post-closure period, and the post-closure use of the site.

I-2a(1) Post-Closure Care Period [40 CFR 264.117(a)(1)]

If any waste residues are left in place, contingent post-closure care activities—as specified in I-2a(2)—will be required to ensure the long-term integrity of the closure and

continued protection of human health and the environment. However, several factors suggest that the duration of any post-closure activities should be limited, including:

- The treatment activities render the waste munitions non-hazardous;
- The risk-based closure activities will ensure that no residues remain in concentrations exceeding established health-based criteria;
- The nature of the treatment, the waste residues, and the closure approach substantially minimize the likelihood of any contaminant migration; and
- Groundwater beneath Holloman AFB has been designated by NMED as unfit for human consumption due to levels of total dissolved solids that exceed human health standards.

Therefore, the post-closure period for carrying out any post-closure activities in I-2a(2) is limited to five (5) years from the date of closure certification.

I-2a(2) Post-Closure Security [40 CFR 264.117(b) and 264.14]

Although the closure plan will ensure that all contaminants are reduced to levels protective of human health and the environment and will minimize the potential for contaminant migration, because some residual contamination may remain in place, security that was used for the management of hazardous wastes will be provided during the contingent post-closure period to prevent access to the site. The security mechanisms that will be in-place during the contingent post-closure period will include the following:

- Utilization of the Base's existing 24-hr security system (guards making routine rounds) to provide continuous monitoring of the unit; and
- Access control to the Base via fence, gate and other entry control devices.

In addition to these measures, the 20,000-Pound OD Unit will be clearly posted

with signs that state, “DANGER—UNAUTHORIZED PERSONNEL KEEP OUT.” These signs will be posted at all entrances and at other locations so as to be seen from any approach to the unit. The legend will be written in both English and Spanish and will be legible from a distance of 25 feet.

I-2a(3) Post-Closure Use of Property [40 CFR 264.117(c)]

The post-closure uses of the property following partial or final closure of the facility may not result in the disturbance of the final grading or vegetative cover. Post-closure use resulting in such a disturbance will only be allowed if necessary [40 CFR 264.117(c)(1)] or required to protect human health and the environment [40 CFR 264.117(c)(2)].

I-2b Post-Closure Care Monitoring [40 CFR 264.118(b)(1) and 264.602]

As discussed in Attachment D-1 of the permit application, an exemption from the requirement to monitor groundwater is being requested for the 20,000-Pound OD Unit. In general, the request for exemption is based on a number of factors, including: 1) the unit does not receive or contain wastes containing free liquids; 2) there is no potential for migration of contaminants to the groundwater; 3) the total dissolved solids (TDS) levels in the local groundwater has led to NMED classification of the aquifer as unpotable; 4) the remote location of the unit results in no potential receptors for the groundwater; and 5) there is no risk associated with the use of groundwater since the resource is not used. Because an exemption is being requested, this post-closure plan does not address any procedures, frequencies for monitoring of the site during the post-closure care period. In the event that the exemption is denied, this plan will be modified to include the appropriate monitoring procedures and frequencies for the OD Unit.

I-2c Post-Closure Maintenance Requirements [40 CFR 264.118(b)(2)]

This section of the post-closure plan summarizes the maintenance activities that will occur at the site as detailed in Section D of the permit application. The majority of maintenance activities will be contingent upon the results of routine (quarterly) inspections. Maintenance activities include maintaining all site markings and other benchmarks, access control devices, and postings. Table I-2 outlines these activities and frequency of occurrence.

I-2d Certification of Post-Closure Care [40 CFR 264.120]

As with the closure plan, certification that all contingent post-closure activities for the 20,000-Pound OD Unit were performed in accordance with the specifications in the approved post-closure plan will be submitted by registered mail to the NMED RCRA Program Manager and/or the EPA Regional Administrator no later than 60 days following completion of all post-closure activities. The certification will be signed by an authorized official of Holloman AFB and an independent registered professional engineer licensed to practice in New Mexico. Documentation supporting the independent professional engineer's certification will be furnished to the NMED RCRA Program Manager and/or the EPA Regional Administrator upon request.

I-3 FINANCIAL REQUIREMENTS FOR CLOSURE AND POST-CLOSURE [40 CFR 264.142 t

Holloman AFB, including the 20,000 pound OD Unit, is owned and operated

Table I-2

Required Maintenance Activities and Schedule

Area/ Equipment	Specific Items	Types of Problems	Corrective Action	Frequency of Inspection
Security Devices	Fence	Broken/ Damaged	Repair immediately if damaged	Quarterly
	Access Gate	Locking mechanism jammed	Repair/replace	Quarterly
	Signs	Illegible	Replace	Quarterly
Final Cover/ Grading	Cover/ Grading Integrity	Subsidence, excessive bare soil, rodent burrows	Restore site to grade	Quarterly (immediately following any 10 year, 24-hour intensity rainfall event)
Run-on/Runoff Drainage Control	Drainage sloping and channels	Settlement, ponded water, blockage, erosion	Repair settlement and erosion, remove blockages	Quarterly
Benchmarks	Not Applicable	Damaged	Replace if Damaged	Quarterly

by the federal government and, as such, is exempt from the financial requirements for hazardous waste management facilities specified under 40 CFR Subpart H. This exemption applies to 40 CFR Parts 264.142 (Cost Estimate for Closure), 264.143 (Financial Assurance for Closure), 264.144 (Cost Estimate for Post-Closure Care), and 264.145 (Financial Assurance for Post-Closure Care).

I-4 SURVEY PLAT AND POST-CLOSURE NOTICES [40 CFR 264.116 and 264.119]

As specified in 40 CFR 264.116 and 264.119, a survey plat and deed notification will be necessary to satisfy the closure and any contingent post-closure care requirements. Therefore, upon completion of all closure activities, a survey plat will be submitted with the certification of closure to the local zoning authority, the NMED RCRA Program Manager, and the EPA Regional Administrator, delineating the boundary of the closed 20,000 Pound OD Unit. Following closure and any post-closure care activities, Holloman AFB's deed will be amended to record the closed unit. This deed recordation will, in perpetuity, notify any potential purchaser of the property that the land has been used in the management of hazardous waste and its use is restricted as specified in Section I-2a(3) of the post-closure care plan and 40 CFR 264.117(c).

I-5 LIABILITY REQUIREMENTS

Holloman AFB, including the 20,000-Pound OD Unit, is owned and operated by the federal government and, as such, is exempt from the liability insurance requirements for hazardous waste management facilities specified under 40 CFR Subpart H.

~~SECTION I~~

~~CLOSURE PLANS, POSTCLOSURE PLANS, AND FINANCIAL REQUIREMENTS~~

~~I-1 CLOSURE PLANS~~

~~The 20,000lb Ed Area site is located in the northwest portion of the Holloman AFB boundary. Figures B-3 and B-4 fulfill the topographic map requirements and indicate the position of the unit within the base property.~~

~~The 20,000lb ED Area site is used to provide treatment to waste propellant compositions. Posttreatment inspections ensure that all energetic materials are treated. Additionally, sampling protocols, described in Section C, are designed to confirm that all energetic wastes are destroyed and that hazardous residuals do not remain in the area. Both residuals do not remain in the area. Both the residuals and underlying soils are sampled to confirm treatment effectiveness and to ensure that no hazardous wastes are disposed of. As a result of these factors, this closure plan presupposes "clean closure." If sampling results indicate that clean closure cannot be achieved, a modification to the closure plan will be submitted 60 days prior to the date scheduled for initial closure actions.~~

~~I-1a CLOSURE PERFORMANCE STANDARD~~

~~This closure plan is designed to ensure that the unit will not require further maintenance, minimize the threat to human health and environment, and control or eliminate the escape of hazardous waste, hazardous constitutes, leachate, contaminated runoff, or decomposition products. This standard is met in the following manner:~~

1. ~~During the active life of the unit, the posttreatment residuals and soils are sampled to demonstrate treatment effectiveness and ensure that residuals are nonhazardous.~~
2. ~~During the interim period between treatment events, the residuals in the unit remain covered in order to retard leachate formation and prevent wind dispersal.~~
3. ~~Annually, residuals and soils are sampled for characteristics of hazardous waste and suspected hazardous constituents. Residuals and soils that do not meet the criteria specific in Section D are removed from the unit until the underlying soil base is "clean". Residuals and soils that are within the acceptable range are covered with natural fill.~~
4. ~~The results of the sampling will be submitted to NMED during the unit's active life.~~

~~I-lb PARTIAL AND FINAL CLOSURE ACTIVITIES~~

~~The closure of the 20,000lb ED Area site is a partial closure that involves closure of only this unit. Closure of all Treatment, Storage, or Disposal Facilities (TSDFs) at Holloman AFB will occur conjunctively with cessation of all base activities. This partial closure will be consistent with the general closure performance standards of 40 CFR 264.601. Coverage after us that occur during the active life of the unit are not considered partial closure. The anticipated date for initiation of these closure activities is January 1, 2050.~~

~~I-1c MAXIMUM WASTE INVENTORY~~

~~No inventory of waste will be present at the 20,000lb ED Area site at the time of closure. The total mass limit per treatment event is 20,000 pounds. The percentage of energetic material in propellant devices is estimated to range from 40 to 50% of the total mass. Consequently, the probable total energetic mass seldom exceeds 10,000 pounds.~~

~~I-1d INVENTORY REMOVAL, DISPOSAL, OR DECONTAMINATION OF~~

~~**EQUIPMENT**~~

~~After the final treatment, residuals and soil samples will be taken in the final pit of the unit to demonstrate that no hazardous wastes remain and that hazardous constituents have not migrated during the active life of the subunit. If sampling results indicate otherwise, residuals and soils will be handled in the manner specified for the active life. The method for removal, disposal, and equipment decontamination, if required, is specified below.~~

~~**I-1d(1) CLOSURE OF CONTAINERS** -- Not Applicable~~

~~**I-1d(2) CLOSURE OF TANKS** -- Not Applicable~~

~~**I-1d(3) CLOSURE OF WASTE PILES** -- Not Applicable~~

~~**I-1d(4) CLOSURE OF SURFACE IMPOUNDMENTS** -- Not Applicable~~

~~**I-1d(5) CLOSURE OF INCINERATORS** -- Not Applicable~~

~~**I-1d(6) CLOSURE OF LAND TREATMENT ZONE** -- Not Applicable~~

~~**I-1d(7) CLOSURE OF LANDFILLS** -- Not Applicable~~

~~**I-1d(8) CLOSURE OF MISCELLANEOUS UNITS**~~

~~**I-1d(8) (a) COVERAGE AFTER USE**~~

~~As previously described, the underlying soils that remain in the pit are sampled and analyzed annually according to the protocols described in Section C. If the analytical results indicate that the residuals are hazardous, the residuals are removed from the pit. Prior to coverage underlying soils are sampled and analyzed at depths of approximately 1 foot intervals for the set of parameters as indicated in Section C. If these results indicate the soils are contaminated above the criteria listed in Section D, both the residuals and the soils will be excavated to a depth of approximately 1 foot. The removal, disposal, and decontamination procedures are summarized below.~~

~~**STEP 1 - INITIAL SAMPLING**~~

~~Following a treatment event and prior to coverage after use, residuals and soils are examined according to Section C. After annual sampling, if the soils are not contaminated, the unit is continued to be used. If sampling results indicated that residuals are hazardous or that underlying soils are contaminated, the remainder of the steps in this section are performed.~~

~~STEP 2 - REMOVAL~~

~~Residues and soil will be excavated to a depth of approximately 1 foot and containerized for disposal as hazardous waste in a permitted TSDF. Prior to disposal, these wastes will be stored in the Defense Reutilization and Marketing Office (DRMO) container storage facility. After removal of the first 1 foot of soil, random coring of soils under the trench will be taken with a hand-held auger to a depth of approximately 1 foot and composited for analysis. Locations were determined or described in Section C. If results indicate that criteria are not met in the first 1 foot, these soils will be removed by standard excavation equipment and managed as hazardous waste. Sampling and removal will proceed in 1-foot layers until the criteria described in Section D are met. Results from analysis of each layer will be submitted to NMED.~~

~~STEP 3 - BACKFILLING~~

~~Once the criteria in Section D are met, the excavation will be backfilled with clean soil. The top layer will consist of mixed soil (gypsum layers and topsoils, mounded to a height of approximately 12 inches, and compacted by a minimum of 5 blade passes. The closed subunit will be identified with 1-foot metal markers along all four sides.~~

~~STEP 4 - DECONTAMINATION~~

~~Upon completion of removal, all equipment used during the closure will be~~

~~emplaced upon a linner that is brought to the area. This temporary base will be diked prior to equipment decontamination. All equipment will be decontaminated by steam cleaning. All rinsewaters will be collected, sampled for parameters of Section C, and if these criteria are exceeded, the rinsewaters will be handled as hazardous waste by storage at the DRMO facility and disposal at a permitted TSDF.~~

~~This form of closure is somewhat analogous to closure of a single cell in a landfill and a schedule for closure in this manner is not required. As indicated, all analytical results will be submitted to NMED and backfilling will not proceed until approval is granted.~~

~~I-1d(8) (b) - UNIT CLOSURE~~

~~The manner of operation for this unit indicates a strong probability that clean closure will be attainable. The steps taken to assure clean closure are described below.~~

~~STEP 1 - INITIAL SAMPLING~~

~~Ninety (90) days prior to the final treatment activities, soil coring samples will be taken by an auger-boring apparatus to a depth of >15 feet. Coring samples will be taken at 10-foot intervals. Sampling locations will be selected by division of the pit area into approximately 1000 grids of equal size and randomly determined in a manner similar to that described in Section C.~~

~~STEP 2 - MODIFICATION OF PLAN 1 CLOSURE NOTICE~~

~~In the unexpected event that sampling results indicate contaminant migration, a modified closure plan will be submitted to NMED. This plan will be based upon the~~

~~extent and nature of contamination in the underlying media. The modified closure plan will be submitted to NMED 60 days prior to initiation of closure activities. If initial sampling results indicate "clean" closure is attainable, these results and a closure notice will be submitted 60 days prior to closure.~~

~~STEP 3 - FINAL TREATMENT/CLOSURE OF FINAL SUBUNIT~~

~~The final treatment event will performed as previously described. The posttreatment and subunit closure results will be submitted.~~

~~STEP 4 - CLOSURE~~

~~Clean closure will be achieved by grading of topsoils to retard erosion and runoff. To the extent practical, vegetative cover will be established. The area will be posted to indicate its previous use in a manner analogous to the current posting. Security procedures will be maintained.~~

~~STEP 5 - CERTIFICATION OF CLOSURE~~

~~Closure will be certified by an independent professional engineer who has had access to the closure plan, final subunit closure results, analysis of the soil cores, and the subunit during the closure activity. Certification of closure will be submitted to the NMED by registered mail within 60 days of completion of the closure action.~~

~~I-1e CLOSURE OF DISPOSAL UNITS~~ ~~-- Applicable~~

~~I-1f SCHEDULE FOR CLOSURE~~

~~A schedule for the closure of the unit is provided as Table I-1. Closure will be achieve within 180 days of the final waste treatment. The anticipated date for closure is~~

~~January 1, 2050.~~

~~I-1g EXTENSION FOR CLOSURE TIME~~

~~No extension for closure time anticipated; however, if an extension is necessary to properly close the 20,000 ED Area, then a petition will be sent amending the Table I-1 closure schedule. This petition will demonstrate:~~

1. ~~the need for more that 180 days to close the site,~~
2. ~~the reasonable likelihood that a person other than the owner/operator will recommence operation of the site, and~~
3. ~~that closure would be incompatible with continued operation of Holloman AFB.~~

~~I-2 POSTCLOSURE~~ ~~-- Not Applicable~~

~~I-3 NOTICE IN DEED~~ ~~-- Not Applicable~~

~~I-4 CLOSURE COST ESTIMATE~~

~~This facility is federally owned and exempt from this requirement~~

~~I-5 FINANCIAL ASSURANCE MECHANISM~~ ~~-- Not Applicable~~

~~I-6 POSTCLOSURE COST ESTIMATE~~

~~This facility is federally owned and exempt from this requirement.~~

~~I-7 FINANCIAL ASSURANCE MECHANISM FOR POSTCLOSURE~~ ~~-- Not Applicable.~~

~~**I-8 LIABILITY REQUIREMENTS** -- Not Applicable~~

~~**I-9 STATE MECHANISM** -- Not Applicable~~

SECTION F

PROCEDURES TO PREVENT HAZARDS

This section addresses security procedures, inspection requirements, preparedness requirements, procedures taken to prevent accidental detonation, prevention of the mixing of incompatible waste, and means to reduce personnel exposure. The procedures outlined in this section are designed to ensure compliance with 40 CFR 264.601 and the general requirements of 40 CFR 264.33 and 40 CFR 264.15. A copy of the standard operating procedures (SOPs) used by the EOD personnel is included in Attachment F-1.

F-l SECURITY

This section summarizes security precautions relative to Holloman AFB and the 20,000-Pound OD Unit within the base confines. Holloman AFB is located on approximately 50,700 acres that consist primarily of unimproved property. White Sands Missile Range and White Sands National Monument bound the base to the north and south, respectively.

F-la SECURITY PROCEDURES AND EQUIPMENT

F-la(1) 24-HOUR SURVEILLANCE SYSTEM

The primary mission of Holloman AFB is to provide upgrade and continuation training for aircrews assigned to T38, F-4, and F-117A aircraft. Additionally, solid base propulsion systems for military devices are tested at the area identified as the Test Track. The general nature of these activities is such that portions of the base facility are under constant surveillance. In particular, such areas include the Test Track Facility, flight line areas, and the munitions building. In addition to these surveillance measures, the main base area and any base area adjacent to these secure zones is patrolled at intervals both day and night. ~~Traffic access to Holloman AFB is provided only by Highway 70 that traverses the southern boundary of the base and La Luz gate on the eastern boundary. Access can also be gained from White Sands Missile Range. Entrances to the base from~~

~~Highway 70 are manned by armed guards 24-hour per day. These general surveillance practices provide general 24-hour surveillance to the treatment unit.~~

Traffic access to Holloman AFB is possible three ways: Highway 70 at the southern boundary of the base; the La Luz gate between Alamogordo and Tularosa; and, through White Sands Missile Range. The two gates are manned by armed guards 24 hours per day. White Sands Missile Range is also under continuous surveillance. These general surveillance practices provide 24-hour surveillance of the treatment unit. Additionally, during detonation events, constant surveillance of the OD Unit is provided by Test Track personnel and the Security Police.

F-la(2) BARRIER AND MEANS TO CONTROL ENTRY

The 20,000-Pound OD Unit is located at the end of a single access road which runs approximately 20 miles along the length of the test track. No fence exists around the OD Unit; however, entrance to the test track area is strictly controlled by Test Track personnel and the Security Police. Entrance to these units is restricted to authorized visitors on approval of the EOD supervisor. Visitors to the unit must be accompanied by EOD personnel. No visitors are allowed during detonation events. Additionally, the treatment unit is provided with only a single entrance. During detonation events, the area is routinely patrolled to prevent access to the OD Unit. A request for a waiver from the requirement to have a fence surrounding the OD Unit can be found in Section B-2(b) of this application.

F-la(3) WARNING SIGNS

Warning signs that indicate the controlled access nature of the treatment unit are present at the ~~entry point to the facility~~ eight posts marking the 20,000-Pound Unit boundary. The unit is posted with signs that state: "Danger, Explosive Disposal Area, Keep Out". The signs ~~at the entrance and along the circumference of the surrounding fence of distances at intervals of 300 feet~~ along the perimeter of the 400-foot-diameter

OD Unit are legible at distances greater than ~~greater than~~ 25 feet. The signs are in English and Spanish.

F-2 INSPECTION SCHEDULE

F-2a GENERAL INSPECTION REQUIREMENTS

The complexity and special nature of the activities conducted at Holloman AFB result in delegation of responsibility for general inspection requirements among various groups. Corrective action for deficiencies found during these routine inspections, repair and preventive maintenance of various items of equipment, and maintenance of inspection records are also delegated among these various groups. Among the areas covered by the routine inspection and maintenance activities are:

- Fire Control Equipment: fire extinguishers, pump truck equipment (pumps, hoses, horns and sirens, etc.) fire alarms, and self-contained apparatus.
- Emergency Equipment: protective clothing, safety glasses, face shields, emergency eyewashes, chemical respirators, etc.
- Security Equipment: ~~fences, gates, locks,~~ facility lighting, signs, etc.
- Structures: road surfaces, vegetation-free zones, fireboards.
- Communication Systems: radios, base intercom, base evacuation system etc.
- Vehicular Equipment: transport vehicles.

An inspection program has been established to inspect all components of the treatment units for malfunctions, deteriorations, signs of contaminant release that indicate potential for migration of hazardous waste constituents to the environment, or the potential for human endangerment. These inspections are performed prior to treatment, after treatment, and at regular intervals during inactivity to permit the use of corrective measures that will minimize such problems.

Vehicles used to transport demolition materials, explosives, and personnel are inspected daily and inspections documented on AF Form 1800.

Table F-1 presents an example inspection schedule for inspecting safety and emergency equipment, security devices, structural equipment, communications equipment, mobile equipment, and range areas. Also listed is inspection of the clear zones around these units for vegetation. Clearing operations of the natural vegetation are then based on these inspections.

F-2a(1) TYPES OF PROBLEMS

The inspections schedule identifies the types of problems (e.g., malfunctions or deteriorations) which are checked during inspections.

F-2a(2) FREQUENCY OF INSPECTION

Inspection of all materials, security devices, safety equipment, and communication devices will be inspected before each EOD operation. This frequency of inspection will determine equipment deteriorations and malfunctions between inspections.

Table F-1 General Inspection Schedule

Area/Equipment	Specific Item	Types of Problems	Frequency of Inspection
Safety and Emergency Equipment	Face shields and extra protective eyeglasses	Broken and dirty equipment	Monthly
	Disposable respirators	Out of stock, not required, filter types for materials being handled.	Monthly, as needed
	Fire extinguishers (Min.= 2)	In need of recharging	Monthly/after each use
	Vehicular radio; handheld radio	Inoperable	As used
	First aid equipment and supplies	Items out of stock or inoperable	As used
	Protective clothing (impermeable full body coveralls, gloves and foot coverings	Holes, thin areas, tears	As used
Security Devices	~~Facility fence~~	~~Corroded chain-fence and barbed wire, burrowing, signs of intrusion~~	~~Bi-weekly~~
	Signs	Illegible	~~Bi-weekly~~ Monthly
EOD Vehicle	Brakes	Worn pads and rotors	Prior to each treatment
	Hydraulics	Leaking	Prior to each treatment
	Horns/sirens	Inoperative	Prior to each treatment
	Trailer hitches	Loose and missing safety chains	Prior to each treatment

	General purpose tool kit	Items missing and damaged	Prior to use

	Pioneer tool kit	Items missing and damaged	Prior to use

	Demolition ordinance/initiation agents	Nonserviceable, exceeds shelf life damaged, corroded, deteriorated	Weekly, prior to use

Treatment Zone	Waste items	Inventory reconciliation	Prior to transport or treatment

	Residuals	Scattered, free-standing liquids	After treatment

	~~Trench walls~~	~~Settlement, cave-in~~	~~Before use~~

	Clear zone/general area	Vegetation, burrowing, corrosion, signs of runon/runoff	Monthly

	Firebreak	Vegetation, scrap, debris	Monthly

	Roads	Settlement, holes, ditches	Annual

F-2b SPECIFIC PROCESS INSPECTION REQUIREMENTS -- Not Applicable

F-2b(1) CONTAINER INSPECTION -- Not Applicable

F-2b(2) TANK INSPECTION -- Not Applicable

F-2b(3) WASTE PILE INSPECTION -- Not Applicable

F-2b(4) SURFACE IMPOUNDMENT INSPECTION -- Not Applicable

F-2b(5) INCINERATOR INSPECTION -- Not Applicable

F-2b(6) LANDFILL INSPECTION -- Not Applicable

F-2b(7) LAND TREATMENT INSPECTION -- Not Applicable

F-2b(8) MISCELLANEOUS UNIT INSPECTION

The inspection schedule used for the treatment unit is provided as Table F-1. This inspection plan addresses unit specific structures, emergency equipment, operational equipment, safety equipment, communications systems, transport vehicles, and the treatment zone (including the cleared area).

Following each detonation, the EOD team inspects the area for kick-out to a distance of 100 feet beyond the projected kick-out zone. The projected kick-out zone is calculated using an equation in an Air Force explosives safety manual, and is based on the type and amount of ordnance being detonated.

F-2c REMEDIAL ACTION

If inspections reveal that nonemergency maintenance is needed, then Holloman AFB personnel will initiate immediate action(s) to preclude further damage and reduce the need for emergency repairs. If a hazard is imminent, or has already occurred during the course of an inspection, or any time between inspections, then remedial action will immediately be taken. Appropriate authorities will be notified according to the Holloman Contingency Plan, Section G of this application. In the event of an emergency involving the release of hazardous constituents to the environment, efforts will be directed towards containing the hazard, removing it, and subsequently decontaminating the affected area as outlined in the Holloman AFB Contingency Plan. The general nature of the remedial action to be taken is noted in the Inspection Log.

F-2d INSPECTION LOG

A log is kept to record inspection findings at the OD Unit as specified in TO 11A-142. The log includes spaces for the date of the inspection, identity of the inspector, and the specific items to be inspected and provides for records of remedial action. These logs are kept on file at the EOD Shop.

F-3 WAIVER OF PREPAREDNESS AND PREVENTION REQUIREMENTS

No waiver is requested.

F-3a EQUIPMENT REQUIREMENTS

F-3a(1) INTERNAL COMMUNICATIONS

~~Refer to the Holloman Spill Prevention and Response (SPR) Plan for information on the alarm system at Holloman AFB~~. Personnel that enter the treatment zone for inspection of operation are provided with hand-held two-way radios. Radio contact with Track Control is maintained at all times while in the restricted area.

F-3a(2) EXTERNAL COMMUNICATIONS

External communications capabilities are provided through the base operator. Communications systems include Defense Switched Network (DSN), FTS, and the US West ~~Southwest Bell~~ System.

F-3a(3) EMERGENCY EQUIPMENT

Refer to the emergency equipment available at the treatment units during operations which includes fire extinguishers, two-way radios, and personnel protective equipment such as gloves and respirators.

F-3a(4) WATER FOR FIRE CONTROL

Water for fire control is not available at this unit. Base fire department trucks are available during operations for emergency response.

F-3b AISLE SPACE REQUIREMENTS -- Not Applicable

F-4 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT

F-4a UNLOADING OPERATIONS

Procedures to prevent incidental detonation of the waste are also applicable to spill prevention during pretreatment operations. These procedures are indicated in Section C. EOD procedures to prevent accidental detonation are detailed in TO 11A-1-42 and TO 11A-1-60. In general, these procedures specify use of nonsparking tools, encasement to reduce impact, use of certain clothing materials, and, most importantly, removal of primers and initial detonators from the device. Additionally, all loading and unloading of explosives is conducted in accordance with DOT protocol. The explosive nature of the waste indicates the greater hazard to be incidental detonation during transfer of waste into the detonation zone. None of the energetic waste contains free liquid.

F-4b RUNON AND RUNOFF

Runon and runoff is negligible because of the low precipitation amounts as discussed in ~~Section E~~ Sections B and D. ~~Runon is prevented from entering this unit by the berm surrounding the treatment area.~~ Additionally, the area surrounding the unit is inspected on a regular basis for signs of visible contamination (detonation fragments or discoloration). Detonation fragments that are discovered are collected and inspected by EOD and detonated again if necessary. for ~~signs of reactivity. If any surrounding soils exhibit signs of visible contamination, the soils will be analyzed by the protocols indicted in Section C and, if necessary, collected for disposal as hazardous waste. In addition, a complete hydrogeological survey will be completed in 1993 to assess runon and runoff affects. Results of the survey will be forwarded to NMED.~~

F-4c WATER SUPPLIES

No water lines are present in the vicinity of these units. Impacts to surrounding groundwater or surface waters are discussed in Section E.

F-4d EQUIPMENT AND POWER FAILURE

Operations at the unit will not be affected if a facility power outage occurs. None of the unit-specific equipment requires electrical power.

F-4e PERSONNEL PROTECTION EQUIPMENT

The equipment appropriate for employees at specific facilities and areas of the plant is specified by EOD orders and the bioenvironmental engineer. They consider the characteristics of the waste types to be handled, including toxicity, ignitability, reactivity, corrosivity, routes of exposure, and similar information. The bioenvironmental staff reports to the On-Site Coordinator (OSC) whenever the Contingency Plan is implemented, and they assist him in specifying the protective equipment for firefighters, rescue teams, spill cleanup personnel, equipment decontaminators etc.

Procedures to ensure safe handling of these reactive waste are detailed in TOs 11A-1-42 and 11A-1-60. All operations are performed by fully-trained EOD personnel

under the direction of the EOD Supervisor. These personnel are familiar with procedures to be followed for the material being handled.

F-5 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES

F-5a PRECAUTIONS TO PREVENT IGNITION OR REACTION OF IGNITABLE OR REACTIVE WASTE

Each waste item that is destined for treatment at the unit is handled in accordance with TOs 11A-1-42 and 11A-1-60. Waste energetic items are not opened at any time due to the potential for incidental detonation. Postdetonation residues are inspected to ensure no untreated waste remains in the zone.

F-5b GENERAL PRECAUTIONS FOR HANDLING IGNITABLE OR REACTIVE WASTE AND MIXING OF INCOMPATIBLE WASTE

The general procedures for handling these wastes are detailed in referenced TO procedures.

F-5c MANAGEMENT OF INCOMPATIBLE WASTE IN CONTAINERS-

No waste is stored at these units prior to thermal treatment.

F-5d INCOMPATIBLE WASTE IN TANKS-Not Applicable

F-5e IGNITABLE OR REACTIVE WASTES IN WASTE PILES-Not Applicable

F-5f INCOMPATIBLE WASTES IN WASTE PILES-Not Applicable

F-5g IGNITABLE OR REACTIVE WASTES IN SURFACE IMPOUNDMENTS- Not Applicable

F-5h INCOMPATIBLE WASTE IN LANDFILLS-Not Applicable

F-5i IGNITABLE OR REACTIVE WASTES IN LANDFILLS-Not Applicable

F-5j INCOMPATIBLE WASTE IN LANDFILLS-Not Applicable

F-5k LIQUID WASTES IN LANDFILLS -Not Applicable

F-5l SPECIAL REQUIREMENTS FOR CONTAINERS DISPOSED IN LANDFILLS -Not Applicable

F-5m IGNITABLE OR REACTIVE WASTES IN LAND TREATMENT -Not Applicable

F-5n INCOMPATIBLE WASTE IN LAND TREATMENT -Not Applicable

As indicated in Sections C and D, the general formulation of these items incorporates multiple energetic compounds in a manner known as a “Detonation Train”. Additionally, the compounds are often commingled in binary or tertiary explosive formulations. For this reason, some of the energetics that are combined exhibit incompatibility under normal conditions.

Attachment F-1

OD Unit Standard Operating Procedures

SECTION D

PROCESS INFORMATION

D-1 CONTAINERS -- Not Applicable

D-2 TANKS -- Not Applicable

D-3 WASTE PILES -- Not Applicable

D-4 SURFACE IMPOUNDMENTS -- Not Applicable

D-5 INCINERATORS -- Not Applicable

D-6 LANDFILLS -- Not Applicable

D-7 LAND TREATMENT -- Not Applicable

D-8 MISCELLANEOUS UNITS

The 20,000-Pound OD Unit provides treatment to waste propellant items that are considered to be characteristically hazardous on the basis of reactivity. ~~The unit consists of a cleared circular area approximately 1600 feet in diameter that is encircled by and approximately 2 to 3 foot earthen berm. Within this cleared area, a pit that is approximately 20 to 30 feet in diameter is excavated to a depth of approximately 10 feet. The subject reactive wastes are placed in the pit, and RDX charges are attached.~~ The unit consists of a cleared area, approximately 400 feet in diameter, within which the explosive ordnance waste is placed on top of the ground. RDX (C-4) charges are strategically attached to the wastes and detonated. During treatment, the initial RDX detonation results in rupture of the propellant casing that allows detonation of the contents to occur. After the detonation, the EOD personnel inspect the surface contents to ensure that all reactive materials have been destroyed.

D-8a TYPE AND QUANTITY OF WASTE

Types of waste that have previously been treated in the 20,000-Pound OD Unit were identified in Section C-1. These wastes may be summarized as propellants that consist primarily of nitrocellulose and nitroglycerin.

RDX charges in the form of an explosive train are used to initiate detonation. The charge, primer, and detonator are not waste items when used in this fashion. The ~~total mass limit~~ net explosive weight (NEW) limit per treatment event is 20,000 pounds of explosive material plus the weight of the casings and detonation devices. Propellant devices typically contain a larger percentage of energetic material per total mass than do explosive items. The percentage of energetic material in propellant devices is estimated to range from 40 to 50% of the total mass. The remainder of the mass of these items is present as the casings or canister that holds the energetic material. ~~Thus, for any given treatment event, the total quantity of energetic material will be less than 8,000 to 10,000 pounds~~. The nature of the generating process (shelf-life exceedance, failure to exhaust during use, etc.) prohibits strict specification of the total mass of the energetic material present in the OD Unit for any discrete treatment event, although it is probable that the total energetic mass seldom exceeds 10,000 pounds. Thus, it is estimated that the total mass of energetic material annually treated in the 20,000-Pound OD Unit seldom exceeds 50,000 pounds NEW.

D-8b(1) LINER EXEMPTION

Recently promulgated 40 CFR 264.601 standards for miscellaneous units indicate that "permits, terms and provisions shall include those requirements of Subparts I through O" of Part 264 that are appropriate to the miscellaneous unit being permitted. Under RCRA standards, all land-based units, with the exception of land treatment, are required to provide liner systems in the design unless exempted from this requirement. A request for exemption from the application of any liner standards is submitted.

D-8b EXEMPTION BASED ON EXISTING PORTION

An exemption on the basis that the 20,000-Pound OD Unit is an existing portion of a land-disposed unit is not requested. The 20,000-Pound OD Unit does not provide

land disposal of hazardous waste, but is utilized for the purpose of treatment and renders the waste nonhazardous in nature.

D-8b(2) EXEMPTION BASED ON ALTERNATIVE DESIGN, LOCATION, AND OPERATING CHARACTERISTICS

An exemption from application of liner standards is requested on the basis of alternative design, location, and operating characteristics. The combined effect of these factors is to significantly reduce the potential for migration of any hazardous constituent from the unit.

D-8b(2)(a) ALTERNATIVE DESIGN

The design considerations that are pertinent to this request are:

(1) Installation of any liner system is impractical for the conditions that are experienced during thermal treatment.

(2) Thermal treatment renders the waste nonreactive and nonignitable. Posttreatment sampling and the management practices for residuals combine to ensure that hazardous wastes are not disposed of at the site. ~~in the trench.~~

The first design consideration that supports the request for exemption from application of liner standards results from the impracticality of liner placement in or near the treatment zones. Placement of any form of liner material directly beneath the waste is prohibited because it would be destroyed.

Theoretical calculations based upon estimated products of combustion indicate that temperatures in the treatment zone will range from 2100°C to 3200°C. Thus, any flexible membrane liner (FML) type material that was placed directly beneath the waste would be destroyed. Furthermore, concrete could not serve as a liner material because detonation during treatment would result in its fragmentation.

During detonation, fragmentation of the ordnance casings occurs as heat input to the item causes pressure to increase within the casings. Upon rupture, fragments of the

casing eject in all directions with great velocity. The impact of these fragments upon any liner material would destroy the containment integrity even if it is assumed that the liner could withstand the temperatures.

~~Placement of a liner at some depth below the treatment zone is not practical since the posttreatment crater sometimes extends to depths of approximately 30 or 40 feet. This consideration indicates the need for a separation between any possible liner and detonation zone that the value of the liner would be questionable.~~

Exemption from application of liner standards is supported on the basis that the 20,000-Pound OD Unit functions as a thermal treatment unit and does not provide for disposal of hazardous waste. Wastes that are input to the OD Unit are considered characteristically hazardous on the basis of reactivity. Posttreatment inspections of the residuals are designed to ensure that reactive fragments do not exist. Furthermore, annual sampling and analysis is performed to confirm that the residuals and underlying soils do not exhibit any of the characteristics of hazardous waste.

Conjunctive treatment nonordnance type waste (i.e., solvents) is prohibited by Technical Order (TO) 11A-1-42 and Holloman AFB Regulation 125-2. Thus, the only listed wasted placed for treatment is nitroglycerin (P081). The detonation train may contain lead azide, lead styphnate, or mercury fulminate in addition to the RDX charge, but these are not waste items. Mercury fulminate is rarely used because of its extreme instability. In these limited number of primers that may contain mercury fulminate, the total mass of this compound is less than 0.24 grams.

Posttreatment sampling of the residues is designed to confirm that the residuals are not ~~reactive~~ hazardous in nature. ~~The parameters for extraction procedure (EP) toxicity, NO_2-NO_3, and TKN are indicated in the posttreatment analytical protocols to confirm that the residual no longer exhibits the characteristics for which these wastes were listed. Residuals that exhibit the characteristic of EP toxicity or reactivity are removed from the unit prior to its posttreatment coverage with active soils.~~ Samples are analyzed to ensure that explosive residues are not present at unsafe levels in the soil. Additionally, samples are analyzed for a suite of inorganic constituents to ensure that they are not present at levels above those naturally occurring in the soils or at levels that

could pose a risk to those exposed to the site. The Sampling and Analysis Plan, Attachment C-1, provides detailed information on the analyses that will be performed.

~~Additionally, the sampling protocols are designed to ensure that additional hazardous constituents are not present in the residuals. The additional hazardous constituents that may be present include dinitrotoluene, tetracene, and antimony based compounds.~~

~~Although some potential exists for dinitrotoluene to enter the trench for treatment, this constituent does not meet the listing criteria for discarded commercial products or products in which the listed constituent is the sole active ingredient. Tetrecene (a nitrosamine-based compound) and antimony sulfide meet only the not otherwise specified (NOS) criteria for hazardous constituents and are not specifically listed.~~

Under the conditions of the thermal treatment, the organic constituents are oxidized to CO, CO_2, N_2, NO_x, H_2O, and are not expected to remain in the residuals. The posttreatment protocols are designed to confirm the destruction of these constituents and ensure that these compounds are not present at the time of subunit closure.

D-8b(2)(b) LOCATION

The location considerations pertinent to the request for exemption from application of liner standards are:

1. The 20,000-Pound OD Unit is located in an area with limited precipitation.
2. The net aquifer recharge rate in the area is negative.
3. The uppermost aquifer is of insufficient quality for use as a potable water supply.

The Tularosa Basin climate is arid with exceptionally low precipitation and low relative humidity. Over a period of 44 years, the average annual precipitation was 7.9 ~~8.3~~ inches. The peak monthly precipitation during this time was 4.5 inches and the maximum 24-hour event for the 44-year period was 2.1 inches.

The mean annual lake evaporation, commonly used to estimate evapotranspiration and aquifer recharge is 67 inches per year. Thus, the annual net precipitation is -59 inches per year and recharge rates to the uppermost aquifer are limited. Additionally, the potential contribution of runon/runoff to contaminant transport is limited because the Tularosa Basin is closed with respect to surface water flows. The limited surface water drainage that occurs within the base is controlled by intermittent streams and arroyos. The 20,000-Pound OD Unit, located in the more elevated portions of the base, is approximately 50 to 100 feet above the main base. No intermittent streams are nearby. Runon that might contribute to contaminant transport is limited due to the low precipitation rate. ~~excluded by an earthen berm of approximately 2 to 3 feet in height.~~ Thus, the potential for contaminant transport by surface water is limited.

~~The depth to the water table is reported as <10 feet in the southern portions of the base. It is considered probable that the water table is at >10 foot depths below the 20,000-Pound OD Unit because the area's surface elevation ranges from approximately 50 to 100 feet above the areas reported to have water table depths of 10 feet. This conclusion is supported by historical evidence that water has never been encountered during treatment.~~ The depth to the water table is approximately 30 feet at the 20,000-Pound OD Unit. It should be noted that the underlying aquifer is naturally high in sulfate and chloride salts (>5,000 ~~10,000~~ ppm). These concentrations render the aquifer useless as a potable water supply. Thus, any unlikely contaminant transport to groundwaters from the 20,000-Pound OD Unit would not result in impacts to drinking water supplies. A future section further describes the hydrogeological factors pertinent to the 20,000-Pound OD Unit and further addresses the potential for contaminant transport.

D-8b(2)(c) OPERATING CHARACTERISTICS

The operating characteristics pertinent to the request for exemption from application of liner standards are:

1. The 20,000-Pound OD Unit provides thermal treatment to wastes that are hazardous primarily due to reactivity. Treatment of these wastes yields nonhazardous residues; thus, no disposal of hazardous waste is performed.

2. Treatment events are not conducted during precipitation events or if such an event is imminent.

3. No free liquids are treated in the unit. Accumulation of free liquids within the residuals contained in the depressions caused by the detonation events ~~trench~~ is prevented by OD Unit operation ~~the pit operation~~.

4. Runon is unlikely to enter the ~~pit~~ OD Unit because of the limited annual precipitation.

5. Residuals are nonhazardous in nature. Organic constituents are converted to gaseous products during treatment. ~~EP metal~~ Inorganic constituents are present in either elemental states or as oxides that are of limited solubility.

6. Inspections and annual sampling are designed to identify the presence of any unreacted hazardous waste or hazardous constituents. Treatment is repeated if unreacted wastes are found in the detonation depression ~~trench~~. Results from the sampling and analysis are reviewed to ensure that there are no residuals that could potentially pose a risk to anyone exposed to the site. ~~Residuals are removed if sampling reveals EP toxicity or unacceptable concentrations of hazardous constituents.~~

Section D-8b(1) discussed the operation of the 20,000-Pound OD Unit as a thermal treatment unit and indicated that hazardous waste is not disposed of in the OD Unit. The TO (TO 11A-1-42) Holloman AFB regulations govern operations at the 20,000-Pound OD Unit. Thermal treatment operations are conducted only during weather conditions that are identified as excellent or fair in ~~Table 1-1 of~~ the technical order. ~~indicated as Exhibit D-1.~~ In general, these conditions allow treatment events only at specified daytime conditions of:

(1) wind speed 3-15 miles per hour,
(2) temperature >55°F, and
(3) clear or partly cloudy skies.

Thermal treatment is not performed during precipitation events. If partly cloudy skies exist, the base meteorological division is contacted to ensure that precipitation is not imminent. The wastes that are treated in the unit contain no free liquids.

The organic constituents of the initial charge are converted to gases during treatment. The distribution of expected gas products from treatment is indicated in Section E-3. During treatment, the oxidant portion of the C-4 detonators (which is the primary potential source of inorganic constituents ~~EP metals~~) is reduced to the elemental form or the oxide as indicated in a previous section. Barium oxide from the nitrate in the priming charge is soluble to the extent of approximately 3.5%. Lead oxide (possibly from primers or detonators) is soluble to the limited extent of approximately 20 mg/L. Antimony and mercury oxides exhibit solubility similar to the oxide of lead. In general, detonators that are the primary potential source for lead or mercury are less than 1.0 gram in mass.

The final operating characteristics consideration is management of residuals to ensure that hazardous wastes are not closed in place at the time of placing the soil cover. Residuals management involves inspections to ensure that all items ~~placed in the pit~~ are destroyed and review of the annual sampling results to ensure that no residuals remain that could potentially pose a risk to anyone exposed to the site, ~~annual sampling and removal of residuals that are characteristically hazardous~~. Inspection requirements and residuals management are further defined in Sections D-8d and F. Posttreatment sampling was discussed in Section C.

D-8b(3) GROUNDWATER MONITORING EXEMPTION

A request for exemption from application of groundwater monitoring standards is submitted as Attachment D-1. ~~This request is based upon consideration of the factors listed below.~~

~~**(1)** The 20,000 OD Unit operates as a thermal treatment unit and the activities conducted at this unit are not considered disposal of hazardous waste. Residuals are inspected and sampled to confirm the effectiveness of treatment. Sampling is also~~

~~designed to ensure that subsoils are not contaminated. Residuals that exhibit hazardous waste characteristics or contaminated soils are removed from the unit.~~

~~**(2)** The groundwater monitoring requirements are defined as waste piles and treatment units, surface impoundments, and landfills that receive hazardous waste after July 26, 1982. No specific groundwater monitoring requirements are applied to miscellaneous units regulated under 40 CFR 264, Subpart X. Sampling protocols of Section C are intended to ensure that operation as a regulated unit does not occur.~~

~~**(3)** The design considerations and operating practices relative to this unit, discussed in the preceding section, indicate that the potential for migrations of constituents is limited. In particular, the factors that limit the potential for migration are:~~

- ~~no free liquids are treated;~~
- ~~construction of the drainage ditch in the trench prevents contact with runon and limited precipitation that might occur;~~
- ~~the mobility of the potential constituents in the residuals is limited. Organics are translated to gas products as discussed in Section E-3. Of the oxides from primary or detonating charges, (P) or (SbO) have solubilities of less than 20 mg/L and only BaO has appreciable solubility.~~

~~**(4)** As described in Section E-1, the location characteristics of the unit indicate the potential for migration is very limited.~~

D-8c DESIGN AND CONSTRUCTION

~~The 20,000lb ED Area consist of any approximately 1680 foot diameter explosive zone area in which approximately 40 t0 60 feet diameter by 10 feet deep pits are alternately developed. Access to this area is provided by a single paved road that terminates at the end the Test Track. A dirt road of approximately one quarter mile is used for access from the paved road to the pit. The unit is used for thermal destruction of~~

~~wasted propellant devices. A total mass limit of 20,000 pounds of waste propellant (including inert casings, etc.) is established for the unit.~~

The 20,000-Pound OD Unit consists of a cleared area, approximately 400 feet in diameter, within which waste propellant devices are placed on top of the ground and subsequently detonated. Access to the area is provided by a single paved road that terminates at the end of the Test Track. A dirt road, approximately one-quarter mile long, is used for access from the paved road to the OD Unit.

The OD Unit has an established limit of 20,000 pounds NEW of waste per detonation . A unit drawing, showing the dimensions and layout of the area, is provided in Figure B-5.

D-8c(1) SPECIFICATIONS

~~Treatment of waste propellant is facilitated by excavation of an approximately 40 to 60 foot diameter pit within the cleared area. The pit is opened, used for thermal treatment, and covered with original soil. Subsequent treatment events are performed by development of excavation in the same location in the same fashion. To limit treatment amount in a single pit, and therefore enhance safety, two pits may be operable at one time. If two pits are used the combined mass of the waste will not exceed 20,000lb.~~

~~Construction of the thermal treatment pit is initiated by submission of a work order from, the EOD office to Holloman AFB Civil Engineering. This work order specifies the general dimensions of the pit, its location, and anticipated date of use. Actual excavation is performed by civil engineering personnel accompanied by EOD specialists. During pit excavation operations, no energetic items are located in the 20,000lb ED Area. Pit excavations are mad with standard earth-moving equipment (backhoe) operated by personnel trained and certified in its use. Similar considerations apply to backfilling operations after treatment events~~

~~The dimensions of either of the initial excavations is approximately 40 to 60 feet diameter by a depth of approximately 10 to 12 feet. The excavation is developed with sufficient sidewall slope to ensure stability. Although these gypsum sands are~~

~~sufficiently concretious in nature to allow sidewalls to be constructed at almost 90° general safety standards dictate sidewall slopes of approximately 2:1 (60°). During treatment, the detonation force widens the trench to a diameter of approximately 70 to 90 feet and a depth of approximately 30 to 40 feet.~~

~~During excavation, soil removed from the trench zone is placed away from the pit. The soil pile is separate from the excavation in order to prevent loose material from reentering the excavation and to prevent any runoff from the soil pile from entering the trench during its active life. During development of the excavation, the trench bottom is lightly compacted to provide suitable foundation for operations.~~

~~Treatment is performed in two designate pit locations, residuals are inspected and sampling is performed annually. Upon return of analytical results that indicate a lack of contamination, the pit is continued to be used. The interim cover is intended to further reduce the limited potential for migration of waste or constituents during periods between treatment events. Treatments are restricted during the time between sampling and analytical results. Upon receipt of verification that contamination does not exist, the subunit is cleared for treatments. Residuals management is further addressed in Section D-8d.~~

Treatment of waste propellant is accomplished by placing the waste on top of the ground within the cleared OD zone. Occasionally, shallow holes are dug in which to place the waste prior to detonation. This is performed in order to control the detonation pattern.

The force of the explosion frequently creates depressions in the ground. These depressions are inspected to ensure that the waste has been completely destroyed and to collect ejected residuals. After every detonation, a bulldozer smoothes out the site, filling in any depression left by the the detonation. The bulldozer is operated by personnel trained and certified in its use.

A unit drawing of the OD Unit is shown in Figure B-5. This drawing shows the dimensions of the OD Unit to scale.

D-8c(2) PROTECTION FROM PRECIPITATION

Protection from precipitation is provided to waste prior to and during treatment events by operating constraints that prohibit thermal treatment during precipitation events. Thermal treatment is also prohibited if such events are imminent. After completion of the treatment event, residuals that remain in the trench are protected from precipitation by the arid climate and backfill procedures discussed earlier.

D-8c(3) RUNON CONTROLS

Several natural factors contribute to a limited potential for runon to enter the OD Unit during the posttreatment period or prior to use of a recently opened unit. These factors include the limited precipitation received in the area, the moderate soil permeability that aids surface water infiltration, the limited relief present in the OD Unit, the OD Unit elevation relative to the surrounding area, and the high evaporative flux present in the region. ~~Although these factors severely restrict the potential for runon entering a subunit prior to use or after a thermal treatment event, several safety factors have been incorporated into the 20,000lb ED Area design and operation. The entire area is surrounded by an approximately 2 t0 3 foot high earthen berm that restricts entry of runon from adjacent areas of higher elevation. Soils from the excavation are separated from the pit opening to prevent runoff from the pile from entering the trench prior to treatment events. Finally, if precipitation occurs during the interim between trench excavation and precipitation occurs during the interim between trench excavation and treatment, the pit is not used until any standing liquids have dissipated.~~

D-8c(4) WIND DISPERSAL CONTROLS

The average annual wind speed in the region is approximately 5.7 miles per hour and the maximum monthly average wind speed is approximately 7 miles per hour. These values indicate limited potential for wind-based dispersion of treatment residuals. The~~residuals. For these wind speed values, the fact that the~~ residuals are located ~~from approximately 30 to 40 feet~~ below the surface as a result of the depressions created by the detonations. This fact, in combination with the wind speed values, will prove sufficient to control wind dispersal. The maximum wind speed value for the 44-year period ending

in August 1986 was approximately 80 miles per hour. If gale-force winds or wind speeds in excess of 15 miles per hour appear imminent, treatment will be postponed (see Section D-8d(1). Wind roses for the previous five years are shown in Attachment E-1.

D-8c(5) SUBSURFACE DATA/SLOPE STABILITY

Subsurface data relevant to contaminant transport in the unsaturated or saturated zones is provided in Section E-1. Four soil horizons ~~are~~ may be traversed ~~in the pit~~ by the depression depths, with the upper approximately 1 foot of soils being predominantly sands that are slightly sticky and nonplastic in nature. Below the 1-foot depth, the soils consist of gypsum that demonstrates transition from non-sticky nonplastic, and moist soil (approximately 20 inches) to gypsum soils that are slightly plastic, slightly sticky, hard, and somewhat friable. Geotechnical data, such as Atterberg limits, unconfined compression, direct shear strength or triaxial compression are not available~~. Therefore, to ensure slope stability of trench sidewalls, an approximate 2:1 slope is used for construction of the trench.~~

D-8c(6) SETTLEMENT POTENTIAL/LOAD-BEARING CAPACITY

~~The subunits are marked to designate their location after backfilling.~~ Waste transport vehicles do not traverse the surface of the backfilled OD Unit depressions, ~~trenches,~~ and the capacity for this type of vehicle is not required. The only equipment that traverses the unit surface is earth-moving equipment required for excavation. The load-bearing capacity of the backfilled ~~subunit~~ depressions is essentially equivalent to that of the unconsolidated materials present in the other undeveloped portion of the base. This capacity is sufficient to support light earth-moving equipment.

Limited subsidence occurs in the subunits because the void volume is relatively unaffected by treatment operations. After treatment, the cover and backfill consist largely of the ~~initially removed~~ soil displaced by the force of the detonation. The ash residues comprise only a limited portion of the fill. However, to retard wind erosion, reduce infiltration, and limit subsidence, the top layer in the cover will consist of mixed soils mounded slightly above the surface and compacted by five blade passes. Settlement

of such a cover is not expected to occur, but any limited subsidence will be replaced by natural action of wind-borne soil motion.

D-8c(7) RUNOFF CONTROLS

The ~~depressed nature of the pit excavation indicates that the~~ potential for runoff contaminated with residuals from the unit is essentially nonexistent. Residuals from the ~~trench~~ depressions are not brought to surface level at any time during the operation except for removal and disposal as hazardous waste (if required). The natural factors (limited relief, moderate soil permeability, low precipitation) that contribute to the limited potential for runon entering the unit also limit runoff from the clear zone. Therefore, no runoff controls are applied at the unit.

D-8c(8) DISTANCE REQUIREMENT

Interim status standards for thermal treatment units that provide detonation of waste explosives and propellant mixtures specify certain minimum distance requirements. These distances are based upon actual poundage of waste explosives present in the unit. Although the actual mass of energetic material present in the 20,000-Pound OD Unit operations is unknown, it is generally expected to be less than 10,000 pounds. For this mass of energetics, the required distance to buildings or adjacent property is 1730 feet (530 m). The clear zone boundary (no unauthorized entry, structures, etc.) is specified as 1680 feet from the 20,000-Pound OD Unit. The nearest building is located approximately 4,000 ~~1750~~ feet from the 20,000-Pound OD Unit.

D-8d TREATMENT PROCESS

The 20,000-Pound OD Unit provides thermal treatment to waste propellant devices identified as hazardous waste due to ~~ignitability or~~ reactivity. Certain constituents that may be present in these wastes could potentially pose a risk to those exposed to them. In order to render the wastes nonreactive and eliminate this risk, they are thermally treated. Once the wastes have been successfully treated, they are no longer considered hazardous. ~~are considered EP toxic or Appendix VIII hazardous constituents. Thermal treatment is facilitated by excavation of a pit that is used for a single detonation~~

~~limited to a total mass of 20,000 pounds.~~ Thermal treatment is accomplished by placing the waste within the cleared OD area and detonating it.

D-8d(1) PROCESS DESCRIPTION/OPERATING PRACTICES

Operational procedures at the 20,000-Pound OD Unit are governed by TO 11A-1-42 and Holloman AFB Regulation 136-2. These orders specify certain atmospheric conditions for treatment operations. In summary, these conditions are:

- temperature: general (>55°F); winter (not specified);
- wind speed: general (4 to 15 miles per hour); winter (7 to 15 miles per hour;
- precipitation: no treatments allowed;
- cloud cover: none or limited; and
- time: 0800 to 1800 hours.

The climatic conditions at Holloman AFB generally allow detonation to be conducted under conditions specified as “excellent” in TO 11A-1-42.

Personnel who perform operations in the 20,000-Pound OD Unit are specifically EOD-trained staff members. The total number of EOD personnel is limited to those required to perform the operation. A minimum of two personnel, one of which is an EOD supervisor, are required for all operations. These personnel are provided both initial training at the Indian Head, MD, school for ordnance and also receive annual reviews concerning ordnance items and RCRA requirements. Section H outlines required training. During all operations, the EOD supervisor operates as the range manager and controls initiation of the thermal treatment. Prior to initiation of the treatment event, all other EOD personnel are required to move and take cover south of the 20,000-Pound OD Unit outside the danger area.

Several efforts are performed prior to the thermal treatment event. All waste energetic items destined for treatment are inspected, logged, and accounted for prior to removal from stock or other designation as waste. It should be noted that these items

become waste primarily through shelf-life exceedance or inequalities noted during inspections of serviceable items. A complete inventory of items to be treated is compiled on the advance disposal request which requires HQ approval before treatment can proceed. Additionally, an inventory of items to be treated is recorded on the EOD Report (~~AFTO 358~~AF Form 3579). Prior to the scheduled treatment event, the EOD supervisor notifies the following base agencies:

- meteorological service (for imminent weather conditions);
- munitions control;
- base medical service;
- security police;
- base operations;
- ~~base fire chief (the IOSC if emergency occurs),~~
- the on-site coordinator; and
- base environmental coordinator.

The waste energetic items are transported in accordance with TO 11A-1-60 and other relevant orders. Prior to transport, the EOD supervisor briefs all members of the team on hazards associated with specific items, pertinent technical data, technical orders, specified treatment procedures, safety precautions, and transport procedures. Upon arrival at the unit, all waste energetic items are inspected and accounted for by comparison with the previously prepared inventory. During transport and operations, all nearby roads are cleared, posted, and maintained free of traffic.

To limit the potential for incidental detonations, all removal primer and detonating items are removed from the waste energetic items. No attempt is made to remove these items if they are integral parts of the device.

The actual treatment is ~~facilitated~~ accomplished by placement of the waste items ~~in the excavation~~ on top of the ground within the OD Unit and attachment of C-4 (RDX) donor charges to the waste item. An “explosive train” is constructed and detonation is initiated from the ~~bunker located in the clear zone~~ designated clear zone. The donor device consists of a series of components that are referred to as an explosive train once the individual devices are placed in combination. An explosive train consists of a primer,

an initial detonating agent, and a high explosive. Explosive train detonation is achieved by step-wise detonation of the ~~proceeding~~ components.

Primers compose an extremely small portion of total explosive train and are present in the device in quantities of 0.04 to 0.2 grams of energetic material.

Primary compositions are mixtures of finely-divided powders of various salts. An oxidant fuel and explosive are combined in the primary composition. Typical oxidants are barium nitrate and potassium chlorate. Fuels in the priming mixture are present in an amount equal to the oxidant (approximately 30%) and are one or more of the following compounds: lead thiocyanate, antimony sulfide, or calcium silicide. The explosive charge constitutes from 5 to 30% of mixture and is highly explosive in nature. Common explosive used in primers are lead azide, lead styphnate, and diazodinitrophenol (DDNP). If the explosive train operates without the use of the initial detonating charge, the explosive in the primer will consist of trinitrotoluene or pentaerythrite tetranitrate (PETN). The remainder of the primer composition consists of inert binders (gum arabic, wax, etc.).

The initial detonating agent for munitions or ordnance consists of a small charge of compressed high explosive. These agents are compounded to have stability to shock or heat that is intermediate between the very sensitive primer and the less sensitive high explosive charge. This charge consists of relatively pure (<99%) explosive similar to that used in the primer composition. The compounds typically utilized as the initial detonating agent include lead azide, lead styphnate, DDNP and tetracene. The total mass of the initial detonating charge is also small and usually consists of less than 100 grams of the agent.

High explosives may be segregated into four classes that are defined as single-compound explosives, binary explosives, plastic explosives, and dynamites. All four categories of explosives are based upon a limited group of energetic materials that are either compounded together (binary explosives) or mixed with inert binders (plastic explosives and dynamites).

Of the approximately 20 compounds that may be used for this purpose, the wastes that are thermally treated at the 20,000-Pound OD Unit use a very limited number of energetic materials. These materials include: nitroglycerin, nitrocellulose, trinitrotoluene (TNT), PETN, trinitrophenylmethylnitramine (tetryl), cyclotrimethylene trinitramine (RDX), and cyclotetramethylenete trinitramine (HMX)).

Many binary explosives are formulated from the components listed above. For example, cyclotol is a mixture of RDX and TNT, octal refers to mixtures of HMX and TNT, and pentolite refers to mixtures of PETN and RDX. None of the binary explosives are thermally treated in the 20,000-Pound OD Unit.

Plastic explosives are formulated by blending certain explosives listed above with binders, waxes, and oils. The energetic materials most commonly used for plastic explosives are RDX, TNT, and nitrocellulose. Certain waste munitions thermally treated at the 20,000-Pound OD Unit incorporate the energetic material's plastic explosive.

Nitroglycerin has been discussed previously in conjuction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately 13°C. The specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at 20°C. Nitroglycerin decomposes with gas evolution at temperatures of 145°C. The published explosion temperature for nitroglycerin is 222° with evolution of approximately 368 Kcal/mol of heat and 715 ml of gas per gram of charge. Nitroglycerin is extremely sensitive to shock, being detonated by a 2 kg weight dropped from a height of 16 cm in the Bureau of Mines reactivity tests. For this reason, nitroglycerin is compounded with other energetics or inerts to facilitate handling. In pure form, it may be absorbed through the skin into the circulatory system and cause increased pulse rate and blood pressure.

Nitrocellulose is a mixture of esters formed by the nitration of cellulose with a mixture of sulfuric and nitric acids. As used in military formulations, nitrocellulose contains a minimum of 12.2% nitrogen. Although nitrocellulose is not truly soluble in any solvent, certain alcohols, ketones, and aromatic nitro compounds will disperse nitrocellulose as colloidal suspension. Water has no solvent action upon nitrocellulose but is absorbed to between 2 to 3% with the resultant deterioration to the unstable form.

Cellulose nitrate has specific gravity of 1.65. The explosive temperature for cellulose nitrate is approximately 230° with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal mol of heat upon detonation that is accompanied by evolution of approximately 700mL of gas per gram charge. Nitrocellulose is extremely sensitive to spark ignition if handled in dry form. The shock sensitivity of nitrocellulose is greater than that of nitroglycerin and is listed as detonation by a 2 kg weight dropped from a height of 9 cm in the Bureau of Mines test.

TNT is available in six isomeric forms although 2,4,6-TNT is the form most commonly utilized. Pure TNT fuses at 80.7°C, has a specific gravity of 1.65, and liquid viscosity of 13.9 CP at 85°C. TNT is among the least sensitive of military explosives, requiring an 85-cm height for detonation by 2 kg weight in the Bureau of Mines test. In addition, TNT has a very high explosion temperature (475°C) and is sensitive to electrical spark only if finely divided. Upon detonation, TNT 245 Kcal/mol of heat and 730 mL of gas per gram of charge. The heat of combustion of TNT is 821 Kcal/mo. TNT derives its value largely from its stability during storage and the ability to melt cast components.

PETN is an aliphatic nitrate formed by the nitration of pentaerythritol [$C(CH_2OH)_4$]. Highly purified PETN melts at 141°C and has a crystal density of 1.76. The heat of combustion of PETN is 600 Kcal/mol. Upon detonation at 215°C, PETN yields 439 Kcal/mol of heat and 790 ml of gas per gram of charge. PETN has an impact sensitivity similar to nitroglycerin (17cm) but is not sensitive to electrical detonation.

Tetryl, (2,4,6-trinitrophenylmethylnitramine) is a nitro derivative of methylsubstituted picramide (trinitroaniline) that is formed by nitration dimethlyaniline. Pure tetryl melts at 130°C and has a crystal density of 1.73. Tetryl yields 324 Kcal/mol of heat with expulsion of 760mL of gas per gram at its explosion temperature of 257°C. The heat combustion of tetryl is 840 Kcal/mol. Tetryl is less sensitive to impact than nitroglycerin but is greater sensitivity than TNT with detonation occurring with a 2 kg weight dropped from height of 26 cm in the Bureau of Mines test. Tetryl is toxic if inhaled with a recommended permissible exposure level (PEL) of 1.5 mg/m^3.

Cyclotrimethylene trinitramine (RDX) or TU is a colorless solid that melts at 204° and has a crystal density of 1.82. Impact tests show RDX to be of similar sensitivity to tetryl with detonation occurring at 32cm. RDX is the second most powerful military explosive with greater power than tetryl or PETN and nearly equivalent power to nitroglycerin. The heat of detonation from RDX is 285 Kcal/mol with formation of 908mL gas per gram charge. The stability of RDX is similar to that of TNT.

HMX is formed during synthesis of RDX. In pure form, HMX has a crystal density of 1.87 and a fusion temperature of 276°. The heat of combustion of HMX is 660 Kcal/mol and the heat of explosion is 390 Kcal/mol. The explosion temperature of HMX (337°C) is greater than RDX but HMX is of equivalent power to RDX upon detonation, yielding approximately 810 mL of gas per gram of charge. HMX is of limited toxicity as is RDX. Unlike RDX, the tetranitramine is seldom used in single compositions but is more commonly blended with TNT under the name Octol. The high explosive device used to detonate these waste items is composition C-4. This high explosive consists of approximately 90% RDX and 10% polyisobutylene.

Inspection of the residuals is performed as soon as the detonation has occurred. Furthermore, the surrounding area is thoroughly inspected to find any ordnance that may have ejected from the unit. If any untreated energetic device is found, treatment is repeated.

D-8d(2) EXPECTED PERFORMANCE/TEST RESULTS

Solid residuals are sampled annually according to the protocols described in the Section C. Upon receipt of the analytical results, the data will be submitted to NMED to demonstrate the effectiveness of the treatment and that no hazardous constituents remain. A letter submittal that identifies sampling location and analytical results will also be submitted. If contamination exists, further action will follow as described in Attachment C-1 to Section C. For areas where contamination is verified to exceed action levels, Holloman AFB, in accordance with NMED, may choose to further evaluate the exceedence using a site-specific risk-based approach, additional sampling results, or remediate affected soils. ~~, the removal, as outlined in Section D-8d(3) will also be communicated.~~

Gaseous reaction products are not monitored during combustion. The expected gas phase products and downwind concentrations are addressed in Section E-3.

D-8d(3) RESIDUALS MANAGEMENT

Although solid residuals rarely remain after detonation, solid residuals that result from thermal treatment remain in the ~~trench~~ depressions unless the sampling results show that the residual levels in soils is above action levels and removal is deemed appropriate. ~~sampling results indicate the need for removal. The following contamination criteria were selected as indicative that residuals from any given treatment event must be removed from the unit:~~

~~**(1)**~~	~~TCLP (metals)~~	~~>TCLP levels~~
~~**(2)**~~	~~organic nitrogen/$N0_3$~~	~~>1000 ppm~~
	~~(indicates nitroglycerin/nitrocellulose)~~	
~~**(3)**~~	~~TNT/RDX~~	~~>1000 ppm~~
~~**(4)**~~	~~Antimony~~	~~10 ppm~~
	~~(1000 times regulatory standard)~~	

~~If these values are exceeded, the residuals are removed from the subunit. In addition to removal of the residuals, the first 6 inches of soil in the trench bottom will also be containerized, labeled, and transported to the DRMO facility as hazardous waste.~~

~~After removal of the first 6 inches, the soils underlying to a depth of 1 foot will be sampled and analyzed to determined if these criteria are met. Successive removal and sampling at 1-foot increments will be performed until the above criteria are achieved.~~

Attachment D-1
Groundwater Monitoring Waiver

SECTION C

WASTE CHARACTERISTICS

This section describes the physical and chemical characteristics of the waste that is thermally treated at the 20,000-Pound OD Unit. The waste analysis plan that identifies sampling and analytical protocols is provided in Section C-2 and Attachment C-1.

The 20,000-Pound OD Unit consists of a cleared area ~~with two pits which are excavated within this zone in order to thermally treat waste-propellant devices~~ within which waste explosives and propellant devices are detonated. The wastes that are treated ~~in these excavations~~ are considered characteristically hazardous on the basis of reactivity (D003). During treatment, ~~a pit is partially filled with subject waste~~ the waste to be treated is placed on top of the ground. Detonation charges that consist of cyclotrimethylene trinitramine (RDX) explosive are added to the pile in order to detonate the waste. The detonation reaction renders the explosive wastes nonreactive and results in both solid and gaseous by-products. Depending upon combustion conditions, the gaseous by-products will consist of carbon monoxide (CO), carbon dioxide (CO_2), water (H_2O), nitrogen (N_2), and various nitrogen oxides (NO_x). Solid by-products include casings from the waste and possibly trace concentrations of incompletely oxidized reactive material. Reaction by-products that are solid will be retained in the ~~pit~~ depression created by the explosive force (except for ejected components), but the gaseous reaction by-products ~~are allowed to~~ vent to the atmosphere. These solid by-products will be gathered and re-detonated or drummed for proper disposal. Due to the difficulties and obvious hazards associated with collection of gas samples in the immediate vicinity of the detonation zone, this plan does not address the gas phase reaction by-products. An assessment of the gaseous constituents released during combustion is

provided in Section E-3.

C-1 CHEMICAL AND PHYSICAL ANALYSIS

Detailed chemical and physical analyses have been performed by the Department of Defense for all military ordnance material. These analyses have been compiled into ordnance material specifications and "Technical Supply Bulletins." Due to the vast amount of knowledge on the composition of ordnance materials that has been assembled for each particular ordnance material, and the dangers involved in deactivating a bomb or explosive, samples of the waste ordnance materials are not routinely obtained and chemically analyzed. Instead, a well-defined knowledge of the constituents used in making the ordnance materials has been compiled. This understanding of the waste constituents is presented in lieu of extremely dangerous predetonation sampling and analysis. Chemical analysis would not yield additional information and could pose a risk to sampling and analysis personnel.

The wastes that are treated in the 20,000-Pound OD Unit are generally propellant devices and explosives with expired shelf lives. ~~Only~~ Rocket motors exceeding 300 pounds are regularly treated at the 20,000-Pound OD Unit. Similar constituents are used in the formulation of the different items, but the quantity of specific energetic materials varies. In addition to the energetic material, the waste consists of the unit metallic components associated with these devices such as the casing. The total mass of the energetic material is typically limited to less than ~~1000~~ 10,000 pounds per device. The energetic materials contained in these wastes are considered characteristically hazardous on the basis of reactivity (D003). Nitroglycerin (P081) is listed on the basis of its reactivity. The reactive wastes are identified as such because these materials are explosives that deflagrate or detonate when subjected to shock or heat. ~~The ignitable components of these wastes are strong oxidizers.~~

Single-base propellants contain nitrocellulose (with 12.5-13% N) as the primary constituent. In addition to nitrocellulose, single-base propellants contain organic nitro compounds, stabilizers, and metal salts. The organic nitrocompounds commonly employed in single-base systems include trinitrotoluene and dinitrotoluene. Organic nitro compounds are utilized to disperse the nitrocellulose as colloidal particles. Stabilizers are required in the composition due to the tendency of nitrocellulose to decompose during storage, particularly as moisture is absorbed. Decomposition of nitrocellulose is an exothermic reaction that is indicated initially by an acid odor or condition that progresses to emission of red fumes and spontaneous ignition as the propellant becomes unstable. Due to this condition, nitrocellulose-based propellants are stored in bulk, are vigorously monitored for pH changes, and are compounded with stabilizers used to retard decay. Typical stabilizers used to retard this condition include diphenylamine, nitrodiphenylamine, diethyl diphenylurea, and petroleum jelly (cordite). As decomposition proceeds, nitrophenylamines, nitroureas, and nitroanilines are formed. This variety of the analogs will be present in waste single-based propellants. However, as the original concentration of the stabilizer seldom exceeds 1.0%, the concentration of those decomposition products will be in the parts per thousand range.

In addition to nitrocellulose fuel, nitro-based dispersion agent, and stabilizer certain propellants incorporate small quantities of metal compounds and elements. These compounds include potassium sulfate, tin and graphite that are not characteristically hazardous.

Double-base propellant formulations include both nitrocellulose and nitroglycerin with limited quantities of stabilizers and additives. Nitroglycerin serves as both the gelatinizing agent and a fuel in these compositions. In addition to the nitroglycerin, small quantities of dibutylphthalate, diethylphthalate, or triacetin are compounded to enhance colloidal suspension of the nitrocellulose. The stabilizing agents for double-base compositions do not differ

from the stabilizers common to single-base systems. However, the metallic additives for double-base systems may include barium or potassium nitrate, calcium sulfate, calcium carbonate, or lead stearate in addition to the metallics used in single-base compositions.

The relative concentrations of these components in propellants varies depending upon the intended end use. In general, nitrocellulose is the predominant constituent and is present in concentrations of 50 to 70%. Nitroglycerin is the second largest constituent in the propellant composition. These two compounds constitute greater than 95% of the standard military double-base formulations. The addition of inerts and stabilizers provides the balance to greater than 99% of the formulation, with less than 1.0% of the formulation composed of various nitrates or lead stearate. In addition to these constituents, triple-base compounds contain nitroguanidine and ethyl centrolite. Triple-base compounds are not typically detonated in the 20,000-Pound OD Unit and are, therefore, not addressed here.

Composite propellants consist of ammonium nitrate ~~pirate~~, an inorganic oxidant such as potassium nitrate, and an organic binder. These propellants are heterogeneous solids that may be press formed to the desired shape. Composite formulations are not handled at the 20,000-Pound OD Unit.

Although the term “colloidal suspension” has been applied to propellants, these compositions are completely solid without free liquids. Physically, propellant compositions consist of powders that are incorporated into solid or waxlike binders and pressed into strips, cords, and other linear shapes. Although dry nitrocellulose is unstable, incorporation of the binders renders the mixture relatively stable. Propellants, including double-base formulations, are not sensitive to shock and cannot be ignited by ordinary shock or frictional effects. Propellants are sensitive to electric spark only if the material has been finely divided and is present as dust. Thus, propellants present a fire hazard to the

degree that a sufficiently strong heat source is available to ignite the composition. Unless finely divided, ignition usually requires either open flame or detonation of a high explosive placed adjacent to the propellant material.

The composition of commonly utilized single-base and double-base propellants is provided in Table C-1. Specific propellants that have been thermally treated at the 20,000-Pound OD Unit are discussed in a future section.

Table C-1

Standard Compositions (%) for Single- or Double-Base Propellant

Nitroglycerin has been discussed previously in conjunction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately 13° C. The specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at 20°C. Nitroglycerin decomposes with gas evolution at temperatures of 145°C. The published explosion temperature for nitroglycerin is 222°C, with evolution of approximately 368 Kcal/mol of heat and 715 mL of gas per gram of charge. Nitroglycerin is extremely sensitive to shock, being detonated by a 2 kg weight dropped from a height of 16 cm in the Bureau of Mines reactivity tests. For this reason, nitroglycerin is compounded with other energetics or inerts to facilitate handling. In pure form, it may be absorbed through the skin into the circulatory system and causes increased pulse rate and blood pressure.

Nitrocellulose is a mixture of esters formed by the nitration of cellulose with a mixture of sulfuric and nitric acids. As used in military formulations, nitrocellulose contains a minimum of 12.2% nitrogen. Although nitrocellulose is not truly soluble in any solvent, certain alcohols, ketones, and aromatic nitrocompounds will disperse nitrocellulose as a colloidal suspension. Water has no solvent action upon nitrocellulose but is absorbed to between 2-3% with the resultant deterioration to the unstable form. Cellulose nitrate has a specific gravity` of 1.65. The explosive temperature for cellulose nitrate is approximately 230°C with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal/mol of heat upon detonation that is accompanied by evolution of approximately 700 mL of gas per gram charge. Nitrocellulose is extremely sensitive to spark ignition if handled in dry form. The shock sensitivity of nitrocellulose is greater than that of nitroglycerin and is listed as detonation by a 2kg weight dropped from a height of 9 cm in the Bureau of Mines test.

C-1a WASTE IN CONTAINERS

~~Most~~ All waste that will be treated at the 20,000-Pound OD Unit will be transported to the treatment area in the original product container or other appropriate packaging. Propellants are contained within chambers that are generally cylindrical in shape and constructed of aluminum and steel. A primary consideration in development of propellant, explosive, or pyrotechnic systems is long-term storage stability which requires compatibility of container and the energetic material.

Receipt of the waste in the product container, combined with the fact that commonly-used military propellants are compatible with one another, ensures the fact incompatible wastes are not mixed. The reactive wastes to be treated at the 20,000-Pound OD Unit are solid in nature and contain no free liquid.

C-1b WASTE IN TANKS --Not Applicable

C-1c WASTE IN PILES --Not applicable

C-1d WASTE IN IMPOUNDMENTS --Not Applicable

C-1e WASTE IN INCINERATORS --Not Applicable

C-1f WASTE IN LANDFILLS --Not Applicable

~~After each treatment event in the 20,000-Pound OD Unit, the residuals are covered with backfill material. The inspection requirements discussed in Section D and the general nature of the waste ensure that residuals no longer exhibit the characteristics of ignitability or reactivity. The waste analysis requirements discussed in Section C-2 are designed to ensure that the residuals are not EP toxic, that hazardous constituents are not present at levels of regulatory concern,~~

~~and confirm that the waste is no longer ignitable or reactive. Residuals that do not meet these criteria are removed from the unit as described in Section D. Thus, the closed trench operates as a solid waste landfill, but is not a land disposal unit for hazardous waste landfill, but is not a land disposal unit for hazardous waste.~~

C-1g WASTE IN LAND TREATMENT --Not Applicable

C-1h WASTE IN MISCELLANEOUS UNITS

This section addresses the specific wastes that have been treated at the 20,000-Pound OD Unit and are expected to require continued treatment at this unit. The waste characteristics and compositions previously presented in this section were provided to fulfill requirements for a general description of the waste characteristics. The previously provided information also gives background data in the unexpected event that a permit modification is required in order to thermally treat any of the compositions that differ slightly from the wastes that have been historically managed.

This section also addresses the characteristics of the waste that must be known for proper management of the waste. This information is derived from published sources. Analysis to support the published data is not required because of the limited deviation allowed within the product specifications that manufacturers of military propellants must follow. The waste that is treated at the 20,000-Pound OD Unit has essentially the same composition as serviceable propellants, but is ~~considered hazardous waste~~ being disposed of because of shelf-life exceedance, deterioration during storage, or failure to complete exhaust during testing of motors.

In general, the characteristics of the waste that must be known are:

- Presence of free liquids,
- Basis for hazard designation,
- Waste composition,
- Ignition or explosion temperature,
- Heat of combustion and/or detonation,
- Sensitivity to shock or electrical ignition,
- Storage stability (tendency to decompose during storage),
- Compatibility with container or other energetic material, and
- Solubility characteristics.

It must be noted that the unique nature of these materials presents difficulties in development of these data in all instances. In some instances, the parameters are not readily measured because of the instability of the material. For many energetic materials, the particle size, degree of subdivision, compressed density of the material in the ordnance, age, and atmospheric conditions affect the value derived for these parameters. The same material may provide different values for certain parameters for no apparent reason. Thus, the published data presented in this section represents the accepted values for those parameters derived from various tests.

Table C-2 identifies all explosive compounds and other substances used or treated at the OD Unit. As shown in Tables C-1 and C-2, there are several explosive materials that are used in a variety of combinations to manufacture explosives and propellant devices. All of these explosives are solid materials that do not contain liquids. The main explosive materials and a description of each are as follows:

- Black Powder—Black powder is the oldest known explosive material. It is a composite material made from saltpeter (potassium nitrate), charcoal, and sulfur. It is a lower powered explosive and is commonly used in time fuses, igniters, and detonators.

Table C-2
Explosive Compounds Used or Treated at the OD Unit

Table C-2 (continued)
Explosive Compounds Used or Treated at the OD Unit

Table C-2 (continued)
Explosive Compounds Used or Treated at the OD Unit

- Ammonium Nitrate—Ammonium nitrate is the least sensitive of military explosives and must be initiated by a booster charge to ensure successful detonation. Ammonium nitrate is commonly used in composite explosives where it is combined with a more sensitive explosive. Ammonium nitrate is highly hygroscopic (readily absorbs moisture) and must be kept in a waterproof container.

- Amatol—Amatol is a mixture of ammonium nitrate and TNT that is commonly used as a substitute for TNT in bursting charges. The most common mixture of amatol is 80/20 (80% ammonium nitrate and 20% TNT). Because of its ammonium nitrate content, Amatol is highly hygroscopic and must be kept in a waterproof container.

- Military Dynamite—Military dynamite is a composite explosive that contains 75% cyclotrimethylene trinitramine (RDX), 15% TNT, and 10% desensitizers and plasticizers. Military dynamite is considerably more stable than commercial dynamites due to the absence of nitroglycerin.

- Trinitrotoluene (TNT)—TNT is the most commonly used military explosive. It is used alone or in conjunction with other explosives for composite explosives. TNT is commonly used for boosters, bursting charges, or demolition charges.

- Tetryl—Tetryl is commonly used alone as a booster charge. It can also be used as a bursting or demolition charge and, at times, can be used in composite charges. Tetryl is more powerful and more sensitive than TNT. Tetryl explosives are being replaced with RDX and PETN explosives due to the increased power and shattering effects of these two latter explosives.

- Pentolite—Pentolite is a mixture of PETN and TNT. The most common mixture of pentolite is 50% PETN and 50% TNT. This explosive is very powerful, has a high detonation rate, and is used in certain shaped charges.

- Nitroglycerin—Nitroglycerin is a highly powerful explosive and is comparable to RDX and PETN. It is commonly used as the base material for commercial dynamites. Nitroglycerin is highly sensitive and is affected by extreme temperatures. Due to its sensitivity, nitroglycerin is not typically used as a military explosive.

- Composition B—Composition B is a composite explosive containing

60% RDX, 39% TNT, and 1% wax. Because of the high RDX content, Composition B is more sensitive than TNT and is primarily used as the main charge in shaped charges.

- Composition C4—Composition C4 is a composite explosive containing 91% RDX and 9% nonexplosive plasticizers. Composition C4 is very stable over a wide range of temperatures and is only slightly water soluble. This explosive is used mainly as a bursting charge.

- Composition A3—Composition A3 is a composite explosive containing 91% RDX and 9% wax. The wax coats the RDX particles and acts as a desensitizer as well as a binder material. Composition A3 is used as a booster charge in newer charges and torpedoes as well as in high explosive plastic projectiles.

- Pentaerythrite Tetranitrate (PETN)—PETN is very sensitive and is one of the most powerful military explosives. PETN is used in boosters, detonating cords, blasting caps, and in composite explosives. PETN is not water soluble.

- Cyclotrimethylene trinitramine (RDX)—RDX is very sensitive and, like PETN, is one of the most powerful of military explosives. It is often used alone as the base charge in M6 (electric) and M7 (non-electric) blasting caps. RDX can also be desensitized and used for sub-boosters, boosters, bursting charges, and demolition charges. RDX is commonly used in the manufacture of Composition A, B, and C explosives.

- Composition B4—Composition B4 is a composite explosive that is very similar to Composition B with 60% RDX, 39.5% TNT, and 0.5% calcium sulfate. This explosive is used in newer shaped charges and bangalore torpedoes.

The composition of ~~the~~ specific propellant devices that have been treated at the 20,000-Pound OD Unit, and that are expected to require continued treatment, is provided in Table C-3. Additives to the double-base propellant compositions are also identified in Table C-3. Single-base or composite propellants are not thermally treated at the 20,000-Pound OD Unit. In addition to the specific formulations for the propellants, Table C-3 identifies the components present in primer compositions or the initial detonating agents associated with these energetic items. The primer is not always treated in conjunction with the

propellant. Table C-4 presents data on the characteristics of the constituent used in these propellants. Data on the explosive train (that is a serviceable ordnance and not waste) is also presented in these tables.

Table C-3

Composition of Specific Propellants Thermally Treated at the OD Unit (also included is the RDX detonator)

Table C-4

Characteristics of constituents in Propellants of Explosives Thermally Treated at the OD Unit (a,b)

Three waste characteristics relevant to proper handling and treatment are not addressed in these tables: (1) the presence of free liquids, (2) compatibility of these wastes with the container, and (3) compatibility with other energetic materials. As previously indicated, the energetic compositions used for these military applications contain no free liquid and consist of finely divided powders or wax-like materials compressed to a variety of shapes. These wastes are managed in the original product container and the materials of the casing were specifically selected at the time of design to be compatible with the energetic material to ensure longevity during storage. Thus, further consideration of these compatibility concerns is not warranted and is prohibitive because of the dangers inherent in any attempt to re-package these materials. Furthermore, these wastes are not re-packaged or stored at the unit. The energetic formulations that are thermally treated at the 20,000-Pound OD Unit are mutually compatible as demonstrated by the fact that these materials are often blended together in a single formulation or conjointly packaged in a single device. In addition to their mutual compatibility, the energetic materials are not removed for blending purposes and, therefore, mixing of incompatible wastes does not occur. Although some limited data concerning reactivity toward water and other reagents are provided in this section, the wastes treated at the 20,000-Pound OD Unit are not mixed with any reagents incidentally or to effect treatment. Such data are provided solely for informational purposes.

~~The wastes that are treated in the 20,000-Pound OD Unit are characteristically hazardous by reactivity or ignitability. Certain constituents, present in trace amounts, are EP toxic. However, the presence of these constituents does not necessarily render the entire waste material EP toxic. The only waste device that may incorporate EP metals is the detonating squib noted in Tables C-3 and C-4. The primer or detonator used to effect treatment is not a waste.~~

The shock sensitivity of energetic materials may be determined by the

Bureau of Mines impact test. The shock sensitivity data provided in this section are based on the Bureau of Mines method. In practice, this method involves placement of 0.02 gram of the subject material in a brass cup that is subsequently impacted by a 2kg weight dropped from a measurement height. Sensitivity is recorded as the height required to initiate detonation in one of ten tests.

Sensitivity to friction is measured by the pendulum test. In this method, a specifically weighted bare-metal shoe is attached to a pendulum designed to pass in contact with a grated anvil containing 7.0 grams of energetic materials 18 times during the test. This sensitivity test is utilized less often than impact and is, therefore, not reported.

Heat and electrical spark sensitivity are determined by several techniques. The most reliably reported data are the explosion temperature as determined by submersion of the subject material in a vat of heated bismuth alloy. Both the explosion temperature and any separately noted spark sensitivity data from energetic materials are reported in this section.

C-2 WASTE ANALYSIS PLAN

This section addresses the parameters of concern for waste treated at the 20,000 OD Unit. The rationale for the selection of these parameters, sampling methods, analytical protocols, and frequency of analysis are described. Parameters and rationale for characterization of waste is discussed in parts C-2a(1) and C-2a(2), which cover predetonation and postdetonation, respectively.

Holloman AFB has never been used for the research and development of nuclear, chemical welfare, or other exotic warfare types of weapons. The OD Unit is used solely for the disposal/treatment of conventional waste-ordnance, munitions, incendiaries, propellants, and rocket motors. The only munitions

delivered or disposed of at Holloman AFB have been conventional live and training munitions. Therefore, the chemical components and combustion by-products are consistent with what is typical for military munitions items; thus, the emphasis of sampling and analysis for the OD Unit should be to search only for the constituents present in these types of wastes.

~~Functionally, the prime constituents are alkoxy nitrates. Inorganic nitrates, chlorates, or peroxides, reactive metals, and inert components (casings and projectiles) are also present. The individual relative components that require treatment are well defined in terms of constituents and are characteristically hazardous by reactivity and/or ignitability. Although certain other constituents are EP toxic in themselves, it is questionable that these components render the entire waste component EP toxic.~~

The nature of the treatment by-products is dependent upon the category of device from which the waste is derived. Propellant constituents will be converted largely to the gaseous products CO_2, CO, H_2O, N_2, and, to some degree, NOx. Some extremely limited possibility exists that these materials may fail to entirely decompose.

The nitrate oxidant from primers or detonators will convert to sodium or potassium nitrite ($NaNO_2$, KNO_2). Other oxidants are converted to the oxide. Fuels such as antimony sulfide or thiocyanate are converted to the oxide or sulfate.

The sampling and analysis plan outlined in Attachment C-1 ~~in this section~~ focuses on solid reaction products because of the hazards associated with plume sampling in the vicinity of the treatment zone. Section E-3 addresses “Air Assessment”.

C-2a(1) PARAMETERS AND RATIONALE (PREDETONATION)

Waste analysis will not be performed prior to the treatment of these wastes. Sampling prior to treatment would so greatly increase the potential for accidental detonation, with resultant property damage and personal injury, that such efforts are not warranted. The containers that hold these energetic materials (product or waste) are sealed in accordance with exceedingly specific manufacturing specifications designed to prolong storage stability and reduce the potential for unplanned detonation or ignition from impact. For example, nitrocellulose propellant mixtures are hygroscopic to 3-4 weight percent if exposed to moist air. The hydrolysis that accompanies exposure of nitrocellulose to air (even at low relative humidity values) renders the material unstable and evolution of NO_2 or auto-combustion occur. Dismantling of the devices (that would be required for sampling) not only increases hazard by exposure of material but increases the potential for detonation due to the friction and shock sensitivity of the materials.

Additionally, the composition of these materials is well defined on the basis of published literature and tightly controlled manufacturing specifications. Thus these materials are analogous to pure discarded commercial products for which sampling would only prove redundant. Prior to treatment of any waste not specifically identified in Section C-1, a complete listing of all ingredients common to that energetic item will be obtained to determine its suitability for treatment in the 20,000-Pound OD Unit.

The use and handling of these materials is tightly controlled and the device is sealed; therefore, the possibility to mix unspecified items with the energetic materials does not exist. No other wastes are treated in conjunction with these devices in the 20,000-Pound OD Unit because joint treatment is specifically prohibited by Technical Orders.

C-2a(2) PARAMETERS AND RATIONALE (POSTDETONATION)

Post treatment analysis of residuals presents less risk to sampling and analytical personnel than attempts to perform predetonation sampling because successful treatment renders the waste non-reactive. Thermal treatment of propellants converts the alkoxynitrates to gaseous products. However, because it is technically impractical to sample evolved gas sampling in the treatment zone, the focus of this plan is the solid residuals that may remain in the pit.

Attachment C-1 contains a detailed Sampling and Analysis Plan (SAP) that covers all aspects of post-detonation waste sampling at the OD Unit. Specific topics covered in the SAP include: sampling approach and rationale, sampling procedures and methodology, health and safety procedures, sample handling and chain of custody (COC), sample documentation, laboratory procedures, quality assurance/quality control (QA/QC), and data evaluation methods. A summary of analytical methods and sampling frequency is provided below.

Samples of the solid residuals and underlying soils will be prepared and analyzed according to protocols from *SW-846, Test Methods for Evaluating Solid Waste*, Third Edition. Samples will be analyzed for all toxic metals, including priority pollutant metals (listed in the New Mexico Hazardous Waste Management Regulations-7, Part V, Appendix IX), explosive residues, and soil moisture. Section 4.5 of the SAP contains the specific test methods and lists of analytes that will be measured, as well as the rationale for their selection. Attachment C-1, Section 8 discusses details of laboratory protocols and quality assurance/quality control procedures.

Samples of the treatment residuals and underlying soils will be taken annually to demonstrate the effectiveness of the treatment and to ensure that hazardous wastes are not present. This frequency was selected to ensure effectiveness of treatment and prevent storage of hazardous waste in the area.

A stratified random sampling methodology will be used to collect representative samples. Attachment C-1, Section 4 explains in detail the sampling methodology.

~~C-2a(2) PARAMETERS AND RATIONALE (POSTDETONATION)~~

~~Post treatment analysis of residuals presents less risk to sampling and analytical personnel that attempts to perform predetonation sampling because successful treatment renders the waste non-reactive and non-ignitable. Thermal treatment of propellants converts the alkoxynitrates to gaseous products. The gaseous products will consist primarily of N_2, CO, CO_2, H_2O, and to some degree NO_x. However, because of the difficulties and hazards of gas sampling in the treatment zone, the focus of this plan is the solid residuals that remain in the pit.~~

~~The potential solid residues include TCLP metals, the original energetic constituents, decomposition products from the energetic materials, the original inerts and additives, and the decomposition products of the inerts. The TCLP metals result from oxidants present in primers. Decomposition of the oxidants yields the TCLP metals in the form of nitrites, chlorides, and oxides that are expected to remain in the solid treatment residues. Thus, certain TCLP metals were selected as parameters of concern for post-treatment sampling and analyses. However, selection of the entire spectrum of TCLP metals was considered unnecessary because certain of these metals are not present in the input materials. The TCLP metals that result from primer or detonation compositions are Ba or Pb, but are contributed to a limited extent. Certain detonation charges may contain mercury fulminate, although the use of this compound in ordnance has been largely discontinued in favor of lead azide or styphnate. Antimony sulfide, present in certain primer compositions, was also selected as a parameter of concern.~~

~~The energetic materials utilized in propellants or explosives contain highly unstable bonds that are readily ruptured during combustion or detonation. The ready disassociation of these compounds with a resultant high gas volume yield is the rationale for their selection as energetic material. During combustion and detonation of these materials, conversion to elemental gases is essentially complete. Thus, the potential for residues that consist of the original constituent~~

~~is limited. Poor oxidative conditions exert little influence upon decomposition of those types of materials since a criterion for the selection of these compounds as explosives is a high-oxygen balance. This criterion is imposed to ensure that the decomposition reactions are driven essentially to elemental gases in order to yield the greatest power upon detonation.~~

~~The possibility for formation of lower molecular weight analogs of the original species is even less than the potential for unreacted energetic species. Both the high-oxygen balance and inherent bond instability in the molecules contribute to complete disassociation once rupture of the bonds is initiated. For example, carbon-to-carbon bonds have disassociation energies on the order of 100-230 KCal/mol, but the dissociation energies for the carbon-nitrogen bonds in aryl structures is on the order of 50-65 KCal/mol. Thus, the nitro groups are readily released from the molecule. Once fragmentation occurs, the NO_2 radical readily oxidizes the hydrocarbon species to CO, CO_2, and H_2O with the nitro group reduced to elemental nitrogen.~~

~~Although the potential for unreacted energetic materials is extremely limited, certain of these were selected as parameters of concern to demonstrate the effectiveness of treatment.~~

~~On the basis, RDX, because of its use to initiate detonation, was selected as a parameter of concern. Analysis of the residual for nitrate and organic nitrogen was selected as parameters to measure the completeness of the combustion of nitrocellulose and nitroglycerin that have lower decomposition temperatures than RDX. In addition, the samples will be tested for reactivity to confirm that reactive wastes have been completely treated. Analysis for any lower molecular weight analogs was not considered because of the tendency of the original constituents to totally decompose. Additionally, prediction of such constituents on the basis of thermo-chemistry and reaction kinetics is precluded due to the complexity of the reaction in the detonation.~~

~~The inerts that are present in the compositions include the binders and additives. Of these materials, only dinitrotoluene, that is occasionally incorporated in propellants, is considered a hazardous constituent. Although it is present in a limited number of compositions and expected to decompose under~~

~~these conditions to NO_x, N_2, CO, H_2O, and CO_2, it was selected for analysis.~~

~~The parameters of concern are summarized in Table C-4. These include certain TCLP metals, antimony, RDX, NO_3-N, Total Kjeldahl Nitrogen (TKN), and dinitrotoluene~~.

~~C-2b TEST METHODS~~

~~Samples of the solid residuals and underlying soils will be prepared and analyzed according to protocols from *SW-846, Test Methods for Evaluating Solid Waste*, Third Edition. The TCLP metals are prepared by analysis of EP extracts by Method 3010 and Method 3050 for total metals. Mercury is analyzed by cold vaporatomic absorption, Methods 7470 and 7471. If aluminum, chromium, or iron interferences prevent quantification of antimony or lead, these analytes will be quantitated by atomic absorption. TKN is prepared by digestion of the residues or soil in sulfuric acid with the digestrate analyzed by ion selective electrode, colormetric, or titrimetric techniques as specified in Method EPA 351.3 (*EPA-600/4-79-020, Methods for chemical Analysis of Water and Wastes.*~~

~~No approved method exists for the quantification of RDX or reactivity. The method selected for this analysis was liquid chromatography as specified *in Journal of Chromatographic science 23:532-4*, 1985. The test method selected to determine reactivity was the Bureau of Mines Impact Test. This method was briefly described in Section C-1. The analytical methods for residuals and soils from the pit are outlined in Table C-4 on the following page.~~

~~C-2c SAMPLING METHODS~~

~~Samples of the treatment residuals and underlying soils will be taken annually to demonstrate the effectiveness of the treatment and to ensure that hazardous wastes are not present. A random sampling methodology will be used to collect representative samples.~~

~~Selection of random samples will be facilitated by division of the pit bottom surface into grids. Each grid dimensions will be approximately 3 feet x 3 feet~~

~~to yield 300-500 grids. Each grid will be successively numbered along the rows until each grid is numbered.~~

~~As described in *EPA/530-SW-84-012, Waste Analysis Plans--A Guidance Manual*, a random number table will be used to select the grids for sampling locations. A description of the use of the random number table for posttreatment and sub-unit closure is provided with the table as Exhibit C-1. The number of samples to be taken is determined by application of ASTM D140-70, *Standard Method of Sampling Bituminous Materials.* The selection table from this method is also provided as Exhibit C-1.~~

~~This sampling methodology will result in division of each pit bottom surface into approximately 300-500 grids that are considered to represent both surface layer and subsoil residuals. Thus, a total of seven or eight samples of surface residuals and subsoils will be taken.~~

~~Soil samples will be taken to a depth of approximately 2 feet with a handheld auger. A minimum of three corings will be taken from the center of each grid and composited in a glass pan that has been precleaned with a soap/water solution and rinsed in deionized water, acetone, and deionized water. Cleaning solution will be brought to the unit to allow cleaning of equipment between each grid sampled. Both the residual and soil samples will be homogenized by the use of a separately dedicated stainless-steel spoon.~~

~~After the sample is composited, a quantity of either the residual material or soil will be transferred to two 8-oz, wide-mouth glass jars with teflon-lined screw-type lids that have been precleaned to EPA protocols. One sample jar will be collected for metals and one for organics. A sufficient quantify of samples will be transferred to the container to completely fill the container volume. The sample jar will be tightly closed, taped, and a sample identification/analyitcal request form will be attached to the container. A corresponding chain-of-custody sample log sheet will be completed by the sampler. Both the chain-of-custody log and the sample tag will identify the grid location from which the cample was taken. Solid samples in the field are preserved by placement of the sample container in an ice chest that contains an ice/water mixute.~~

~~Table C-4. Parameters of Concern for Treatment Residuals in the 20,000lb ED Area~~

~~Parameter~~	~~Preparation Method~~	~~Analytical Method~~
~~Specific EP Metals~~	~~1310~~	~~1310~~
~~Barium~~	~~3010,3050~~	~~6010~~
~~Mercury~~	~~7470, 7471~~	~~7470, 7471~~
~~Lead~~	~~3010, 3020, 3050~~	~~6010, 7421~~
~~Antimony~~	~~3020, 3050~~	~~6010, 7041~~
~~Cyclotrimethylenetrinitramine~~	~~Lc[a]~~	~~L.C.~~
~~NO_2 - NO_3~~	~~9200~~	~~9200~~
~~Total Kjeldahl Nitrogen~~	~~351.3~~	~~351.3~~
~~Reactivity~~	~~NA[b]~~	~~Bureau of Mines Impact Test~~
~~Dinitrotoluene~~	~~3540, 3550~~	~~8250~~

~~[a] L.C. = liquid chromatography~~
~~[b] NA = not applicable~~

~~C-2d FREQUENCY OF ANALYSIS~~

~~Sampling, as specified in Section C-2(C) and the corresponding analysis indicated in Section C-2(b), will be performed annually. Although historically only about six detonations are performed each year, this frequency was selected to ensure effectiveness of treatment and prevent storage of hazardous waste in the area.~~

~~**EXHIBIT C-1**~~

~~**SELECTION OF RANDOM SAMPLES**~~

~~EXHIBIT C-1~~

~~SELECTION OF RANDOM SAMPLES~~

~~The random number table included to this exhibit is used in the following manner:~~

1. ~~The sampler proceeds to the row that corresponds to the month of the sampling event.~~

2 ~~The sets of numbers are followed across the selected row until the sets that correspond with the date of the sampling event are reached.~~

3. ~~The counting location within the grid selected by the preceding steps is selected by counting horizontally and vertically to the digit occupied by the last tow digits of the present year. For 1988, the starting location is identifies as the 8th column in the grid and the 8th row of the grid. Rows 1-5 are in the first set of digits and rows 6-10 are the second set of digits. For a sampling event on 10/14/88, the beginning number in the identified grid is "2".~~

4. ~~Proceeding left to right, each set of two digits (i.e., 24, 88, 35, 33, 25,44, 01, 78, 03, ect.) are selected. Values larger than the sample population are discarded. For trench sampling with 30 cells, the locations would be grids 24, 25, and 01 If both residuals and soils are taken, the sample locations are grids 24, 25, and 01. Grids 03, 18, and 05 will be sampled for soils. If a value is repeated (i.e., 18, 18), the value is used only once.~~

~~The following table is from ASTM D140-70 and is used for selection of the required number of samples in dry unconsolidated materials. An example of grid numbering for both residuals and soils is provided on the following pages.~~

SECTION B

FACILITY DESCRIPTION

B-1 GENERAL DESCRIPTION

Holloman Air Force Base (AFB) is located on approximately 50,700 acres of land in Otero County of South-central New Mexico. The Facility lands are situated in the northern Chihuahuan Desert in the region known as the Tularosa Basin that is bounded to the east and west by the Sacramento and San Andres Mountains, respectively. The base is located adjacent to White Sands Missile Range and White Sands National Monument is located west ~~south~~ of the base. Regional water supplies are derived from Bonita Lake located approximately 60 miles north of the base and the Boles, Douglas, and San Andres Well Fields located 14 miles to the southeast.

The nearest population center is the city of Alamogordo located approximately 7 miles to the east. Regional metropolitan centers include El Paso, Texas, located 75 miles south-southwest and Albuquerque, New Mexico, located 210 miles north of the facility. The primary transportation route for the facility is Highway 70 that traverses the southern boundary of the base in a northeasterly direction. The general location of Holloman AFB is depicted in Figure B-1~~, volume 2~~.

Holloman AFB was initiated as a temporary facility developed to provide gunnery and bomber training to aircrews during World War II. The base mission was altered in the postwar years to the development of pilotless aircraft, guided missiles, and associated equipment. In the late 1950s the base was transferred to the Air Force Systems Command (AFSC) and designated as the Air Force Missile Development Center. On January 1, 1971 , the base mission expanded to provide lead-in fighter training for the 479th Tactical Training Wing and its components.

Figure B-1. General Location of Holloman Air Force Base

Currently, Holloman AFB hosts the Air Combat Command (ACC) 49th Fighter Wing, which includes pilot training, mobility support, and combat support operations. The primary Air Force Materiel Command (AFMC) component located at Holloman AFB is the ~~6586th~~ 46th Test Group, which is responsible for evaluation of propulsion and navigational systems for aircraft, space vehicles and missiles. A variety of tenant organizations are assigned to Holloman AFB including the 4th ~~Satellite~~ Space Warning Squadron, the New Mexico State University Primate Research Laboratory, ~~the 4th and 25th Weather Wing~~ and Det. 4, the 50th Weather Squadron. A general layout of the facility is provided in Figure B-2.

As a result of ACC readiness requirements and the 46th Test Group activities, a variety of ordnance, munitions, incendiaries, and propellants become waste because of exceedence of shelf-life, unanticipated deterioration, or failure to attain specifications that render the device non-serviceable. These waste explosives are considered characteristically hazardous under the Resource Conservation and Recovery Act (RCRA) due to reactivity (D003). Rocket motors that exceed 300 lbs are treated at the 20,000-Pound ~~Explosive Disposal~~ Open Detonation (20,000-Pound OD) Unit that is the subject of this permit. These units are regulated under 40 CFR 264, Subpart X, codified at 40 CFR 264.600 *et seq*.

~~The 20,000lb ED Area consists of a clear zone of a clear zone of approximately 1680 feet in diameter. A graded circular area of approximately 200 feet encircles the treatment pits and has an earthen berm that ranges from approximately 1 to 2 feet in height. A firebreak of approximately 6 feet in width encircles the entire area and also serves as a security road for the unit.~~

The 20,000-Pound OD Unit derives its name from the relevant operating procedures for this treatment activity. The net explosive weight (NEW) of solid propellant rocket motors that are simultaneously treated in the trench is limited to 20,000 lbs (i.e., 20,000 lbs per treatment event). This total does not include the mass **Figure B-2. Facility Layout of Holloman Air Force Base.**

of the casings, other associated containment devices, and detonating charges. Although the precise number of treatment occurrences during any year is variable, discrete treatment events occur at typical frequencies of one event ~~every 2-3 months~~ per month. However, it is possible that several treatment events could occur per month. More specific information on ordnance constituents, ~~trench construction~~ the OD Unit, and operating procedures is provided in future sections.

~~The treatment zone is developed by excavation of two circular pits, approximately 20 feet apart, with approximate dimensions of 40 to 60 feet diameter and 10 feet in depth. Treatment of the wastes is accomplished by placement of the propellant item and C-4 charges into the deepest pit with the waste subsequently detonated. After completion of the detonation, the area is thoroughly inspected to ensure that the waste has been destroyed and to collect ejected residuals. Once inspection is completed, the pit is closed by backfilling with the original soil. The location of this unit and its surrounding area relative to the main base is provided in Figure B-3, Vol 2.~~

The 20,000-Pound OD Unit consists of a clear zone approximately 400 feet in diameter. Treatment of the wastes is accomplished by placing the explosive ordnance on top of the ground within a 100-ft diameter area at the center of the clear zone. The waste is then treated by detonation. The force of the explosion often creates a depression in the ground, which is inspected to ensure that the waste has been completely destroyed. Residuals ejected outside of the depression are collected and returned to the depression. ~~Subsequent detonations are performed at locations surrounding the first depression within the 100-ft diameter detonation area. When the detonation area is covered with depressions,~~ Following the detonation, a bulldozer smooths out the site, filling in the depression. The location of the OD Unit and its surrounding area relative to the main base is provided in Figure B-3 and B-4. A unit drawing of the area, showing dimensions of the unit, is provided in Figure B-5.

Figure B-3. Topographic Map of the 20,000-Pound OD Unit.

Figure B-4. Location of the 20,000-Pound OD Unit and Surrounding Landuse.

Figure B-5. Detailed Drawing of the 20,000-Pound Open Detonation Unit

(Figure forthcoming pending survey data from the Unit)

B-2 TOPOGRAPHIC MAP

The general requirements are met in a topographic map of the 20,000-Pound OD Unit and the surrounding area in Figure B-3. The provided topographic map indicates that the unit is located in relatively flat terrain; the OD Unit is also above the 100 year floodplain boundaries. No surface water of constant flow conditions is located in the area, although arroyos that contain runoff are located in the vicinity of the unit.

The topographic map delineates the area relief at intervals of 10 ~~25~~ ft.~~ the map scale of 1 inch equal to 400 feet is used in all Holloman AFB facility maps. Because of the cleared nature of the area and limited topographic relief, this topographic map delineates the area in the same detail as that provided by a scale of 1 inch equal to 200 feet.~~ Figure B-3 shows a large and small scale topographic map of the Unit. The large scale map is at a scale of one inch equal to 300 ft and shows topography in a 3000 by 2500-ft area around the Unit. The map is presented at that scale because all topographic contours are visible and a larger portion of the area surrounding the Unit can be seen. The small scale map shows the topography of the surrounding area and all hydrologic features in the vicinity of the unit.

B-2a SURROUNDING LAND USES

The 20,000-Pound OD Unit is located approximately 1000 ~~2600~~ ft within the northern boundary of Holloman AFB. White Sands Missile Range lies to the north and west of the adjacent base boundaries. All lands within Holloman AFB boundaries are under the control of the U.S. Air Force. Thus, the unit is surrounded by access-controlled Federal lands for a distance of several miles in all directions. Figure B-4 shows the land use immediately surrounding the OD Unit. The unit is situated on undeveloped grassland near areas of barren land (dunes) and arroyos and is isolated from commercial and residential landuses. The closest building on or off the Facility is approximately 4000 ft from the OD Unit. Figure B-3 show the distances to the nearest residential buildings (72,700 ft), public roadway (48,000 ft), and passenger railroad (85 miles).

B-2b UNIT BOUNDARIES

~~The unit boundary is designated in Figure B-4. This figure also delineates the clear zone surrounding the unit which extends to a radial distance of 8150 feet.~~ The unit drawing for the OD Unit, showing unit boundaries, is shown in Figure B-5. Holloman AFB facility boundaries are designated in Figures B-3 and B-4.

B-2c WIND ROSE

Wind roses are provided separately in Attachment E-1 ~~Exhibit E-6~~ for the five most recent years. Pertinent meteorological data, including wind dispersion modeling, are also provided in Section E-3.

B-2d ACCESS CONTROL

Access to the unit is provided by a single paved road that terminates at the entrance to the unit. Access is strictly controlled by Test Track safety personnel with radio contact with the Track Control Facility. All visitors and Holloman AFB personnel are required to check in at the Test Track Control Facility and the location of all vehicles is monitored in the northern portion of the Base. During detonation events access is not permitted. Additionally, traffic access to Holloman AFB is possible only through two gates and through White Sands Missile Range. The two gates are manned by armed guards 24 hours per day. Access to White Sands Missile Range is also continuously guarded. Because access to the OD Unit site is strictly controlled via the means listed above, Holloman AFB is requesting a waiver for the requirement of a fence at the OD Unit.

B-2e INJECTION AND WITHDRAWAL WELLS

No injection or withdrawal wells are located within the unit's boundary or the adjacent area. ~~There are no wells located within the clear zone surrounding these munitions areas.~~ The location of groundwater wells within the boundaries of Holloman AFB and the location of wells in the areas adjacent to the base boundaries are discussed in Section E-1. Hydrogeologic data for Holloman AFB are also presented in Section E-1.

B-2f STRUCTURES

No buildings are located within the 20,000-Pound OD Unit. All nonordnance-related structures located within the clear zone are vacated prior to operations and cordoned off during the operations.

B-2g RECREATION ACCESS

No recreation areas are located in the vicinity of the 20,000-Pound OD Unit.

B-2h RUNOFF CONTROL SYSTEMS

Runon and runoff control systems are not present in the vicinity of the 20,000-Pound OD Unit. Such systems are unnecessary in the area of the unit due to limited precipitation received, ~~and the limited slope of the surrounding area.~~ moderate soil permeability that aids surface water infiltration, the limited relief present in the OD Unit, the OD Unit elevation relative to the surrounding area, and the high evaporative flux present in the region. For these reasons, Holloman AFB is requesting a waiver for the requirement of a berm at the 20,000-Pound OD Unit.

B-2i ACCESS AND INTERNAL ROADS

The only access to the 20,000-Pound OD Unit is a paved ~~surface~~ road that terminates at the entrance to the unit. There are no roads inside the OD Unit boundaries.

B-2j STORM, SANITARY, AND PROCESS SEWERS

No storm sewers, sanitary, or process-related conveyances are located within the vicinity of the 20,000-Pound OD Unit.

B-2k LOADING AND UNLOADING AREA

Explosive ordnance is unloaded strictly at the ground location at the time

designated for the treatment event. Explosive wastes are ~~generally~~ transferred directly from the transfer vehicle to the ~~pit~~ area on the ground where detonation will occur; no waste transfer or pickup stations exist. Loading and unloading of the vehicles strictly follow Department of Transportation (DOT) protocol. Procedures to prevent hazards during loading/unloading operations are addressed in Section F, "Procedures to Prevent Hazards".

B-2l FIRE CONTROL FACILITIES

There are no fire control facilities at the 20,000 OD Unit. Immediate response fire control equipment, such as fire extinguishers and shovels, are brought to the unit during operations. Base Fire Department capability is available to respond to emergencies should such an event occur. The fire department is notified 24 hours prior to thermal treatment events.

B-2m SURFACE WATERS

Surface water flows in the vicinity of Holloman AFB are generally intermittent in nature. The topographic map provided in Figure B-4 ~~indicates~~ shows the surface water features in the area. The boundaries for the 100-year and 500-year floodplains are not near the unit. Surface water flow patterns and draws that contain intermittent flow are further discussed in Section E-2.

B-2n FLOOD CONTROL/DRAINAGE BARRIERS

No structures for the control of flooding or drainage are present at the 20,000-Pound OD Unit. ~~An earthen berm of approximately 2 feet in height surrounds the entire treatment zone and provides some runon control~~. The unit is elevated sufficiently above the floodplain elevations that flooding potential is considered virtually nonexistent. Due to moderate soil permeability, limited relief in the area, the elevation of the OD Unit, and the high evaporative flux in the region, limited drainage from the area is expected. Therefore, no drainage barriers exist at the OD Unit.

B-3 LOCATION INFORMATION

The 20,000-Pound OD Unit is exempt from seismic considerations because the unit is located in Otero County which is not among the political jurisdictions designated in Appendix VI, 40 CFR 265.

B-3a FLOODPLAIN STANDARD

The 20,000-Pound OD Unit is not located within the 100-year or 500-year floodplains of intermittent streams in the area. ~~The 100-year and 500-year floodplains are designated in the topographic map provided as Figure B-4.~~ Additional information related to surface drainage patterns is provided in Section E-2, “Surface Media Assessment”.

B-4 TRAFFIC INFORMATION

Access to the 20,000-Pound OD Unit is provided by a single paved road. A dirt road provides access from the paved road to the edge of the OD Unit ~~excavated pits~~. The detonation area is ~~pits are~~ approximately one quarter mile from the paved road.

Traffic along this route is restricted to official use of the EOD personnel during explosive operations, but may be accessed by Test Track personnel who are needed during operations.

As a result of these restrictions, the typical traffic volume and pattern consist of a maximum of several vehicles per day that are in transit to or from the unit. The precautions taken to ensure safe transport of the waste to the unit are described in Sections D and F.

B-4a ACCESS ROAD SURFACE

The single access road to the unit designated in Figure B-3 is a paved surface. This surface is periodically maintained to prevent formation of holes, ditches, or other deformation that would increase the possibility of accidental detonation during transport.

B-4b LOAD-BEARING CAPACITY

The paved service road was graded and compacted to provide capacity for automobiles, light trucks, heavy trucks, and service vehicles. The maximum amount of waste moved per vehicle movement along the paved surface road is 40,000 pounds. This total weight includes not only the net explosive weight but weight from inert casings, canisters, etc.

Attachment F-1
OD Unit Standard Operating Procedures

Two Weeks Prior to Scheduled Detonation:

1.EOD chief selects EOD team. EOD chief conducts a briefing with the team, which includes the following topics: hazards involved, treatment procedures, pertinent technical orders to reference, safety precautions, and transport procedures.

2.EOD team conducts a range inspection in accordance with permit requirements. Specific problems inspected for include free-standing liquids, unexploded munitions, vegetation, burrowing, signs of runon/runoff, and debris. The EOD team also inspects the road leading to the OD unit to identify holes, ditches, or settling that could cause problems during the transportation of the munitions.

3.EOD team checks all items listed for treatment to identify proper disposal techniques, and calculates the total mass being detonated. The team ensures that the total mass does not exceed 20,000 pounds NEW per event, and also calculates net explosive weight.

4.EOD team notifies the flight munitions custodian of explosive requirements, to ensure that explosives will be on hand prior to scheduled operation.

5.EOD team ensures that all inspections of emergency response equipment, safety equipment, security devices, EOD vehicles, and operating equipment are up-to-date and that no problems exist.

One Week Prior to Scheduled Operation:

1.EOD team chief checks and verifies items to be treated, and checks calculations regarding amount of explosive to be used and net explosive weight.

2.EOD team chief checks with munitions to make sure explosives will be on hand for treatment event.

One Day Prior to Scheduled Operation:

1.EOD chief conducts briefing with team on the pending operation, and makes team assignments.

2.EOD team contacts munitions to draw explosive materials.

3.EOD team contacts munitions storage to ensure delivery time will be met.

4.EOD team draws and inspects all necessary equipment to ensure operability.

5.EOD team notifies base fire department, medical services, security police, base operations staff, and base environmental coordinator of pending operation.

6.EOD team contacts base meteorology team to get a forecast of predicted weather conditions for the following day, and to notify them of the operation.

7.EOD chief performs the calculation presented in an Air Force explosives safety manual to determine the projected kick-out distance of the detonation. This calculation is dependent on the type and weight of the ordnance being detonated.

Day of Scheduled Operation:

1.EOD team contacts base meteorology team to ensure that all weather conditions meet permit terms, including wind speed and direction, temperature, stability, and precipitation.

2.EOD chief conducts safety briefing with all team members, as well as highlights transportation of explosives requirements and procedures.

3.EOD chief provides arms to personnel who will be transporting explosives. Conducts a briefing on the use of firearms.

4.EOD chief ensures that radio communication lines are kept open with the EOD team during the drawing and transportation of explosive materials.

5.EOD team proceeds to munitions storage. EOD chief supervises the munitions loading operations according to DOT protocol.

6.EOD team transports munitions and explosives to OD unit.

7.EOD team conducts a final inspection of the OD unit.

8.EOD chief makes radio contact with the test track control and the EOD operations center. Ensures mobile two-way radios are placed in appropriate locations (with team members, track control net, team chief, and safety observer).

9.EOD team conducts a physical inspection of all munitions brought for treatment. Compares inventory listing with letter of disposal request to ensure all items are accounted for. (Only items identified on the letter of request can be treated; all others will be refused and returned to munitions storage for reschedule.) EOD chief will monitor and identify and deficiencies and refuse treatment if discovered.

10.Once inventory is completed, EOD team places items in the area for treatment.

11.EOD chief segregates initiation explosives and prepares firing set-up.

12.EOD team sets up dual-primed firing systems to initiate the main charge.

13.EOD chief checks firing systems in primed positions.

14.EOD team and EOD chief withdraw to safe area.

15.EOD chief obtains approval for detonation from the Holloman tower via test track control.

16.Waste is detonated.

17.Once detonation is evident, EOD chief makes long range reconnaissance of the surrounding area to determine presence of possible kick-outs and/or fires.

18.EOD chief dispatches two EOD team members to inspect the shot. Once the site is determined clear, remaining EOD team members can return to the detonation area. The OD unit is inspected to determine that the munitions were completely destroyed, to a distance of 100 feet beyond the projected explosive kick-out zone.

Post Operation Procedures:

1.Within 24 hours of the operation, the EOD chief will sign all required expenditure documentation, and place a copy in the project folder. A copy of the EOD report will be prepared, including an inventory listing and a list of personnel participating. The report will include the net explosive weight amount and the facility used.

2.EOD team cleans and inspects all EOD vehicles and other equipment.

3.If necessary, EOD chief makes arrangements to have depressions in the OD unit backfilled.

4.EOD chief insures that all inspection logs, correspondence, and other pertinent information are placed in the files at the EOD shop.

Attachment C-1
Sampling and Analysis Plan

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1.0 INTRODUCTION

1.1 Background

This Sampling and Analysis Plan (SAP) has been prepared to support the Resource Conservation and Recovery Act (RCRA) Part B Permit Application for the 20,000-Pound Open Detonation (OD) Unit at Holloman Air Force Base (AFB), New Mexico. This SAP provides procedures for the required environmental sampling at the 20,000-Pound OD Unit which is used to treat waste explosives. Environmental sampling is necessary to demonstrate that the OD Unit is operating in a manner such that residual waste constituents are not contaminating soils above risk-based cleanup levels and/or background levels. The plan contains sampling and analysis protocols for three distinct phases of environmental sampling at the OD Unit:

1. Background sampling to establish site-specific background constituent concentrations;

2. Routine, or operations, sampling to test the soils at the OD Unit for the effectiveness of the treatment process and to ascertain whether any contamination has impacted ambient soils;

3. Closure sampling to be completed in the event that Holloman AFB terminates operations at the OD Unit.

1.2 Technical Approach

The SAP design is based on U.S. Air Force (USAF) OD operational procedures, knowledge of the waste munitions' characteristics, and the environmental conditions at Holloman AFB. Where applicable, the procedures and quality assurance/quality control (QA/QC) techniques in U.S. Environmental Protection Agency's (EPA's) November 1986 *Test Methods for Evaluating Solid Waste* have been used to prepare this SAP. The detailed sampling and analysis methodology is described in Sections 3 through 9 of the SAP. A brief description of the technical approach follows in this section.

Prior to any routine monitoring, one round of background soil samples will be collected outside areas potentially impacted by the OD Unit. These samples will serve to characterize conditions of soil similar to the OD Unit but unaffected by past practice.

For operations monitoring purposes, the OD Unit will be sampled quarterly using a stratified random sampling approach. As described in detail in Section 4 of this SAP, the Unit will be subdivided into three distinct areas, or strata. Discrete samples of near surface soil will be collected from random locations within each strata and analyzed for explosive and metal constituents. Analytical results will be compared to background results and calculated risk-based concentrations to determine whether operations at the OD Unit are affecting soils at the site.

In the event that Holloman AFB terminates operations of the 20,000-Pound OD Unit, a final round of sampling will be completed. Closure sampling will use the same decision criteria as operations sampling and incorporate previous sampling results.

1.3 Data Quality Objectives

Data quality objectives (DQOs) are statements that define the type, quantity, and quality of data necessary to address a problem before a study begins. The EPA has published a seven-step process to DQO development as guidance (U.S. EPA, 1993). These seven steps have been designed to allow decision makers to define their data requirements and acceptable levels of decision errors during planning, before the data is collected. Following the DQO process ultimately leads to a more efficient data collection design. Table C.1-1 describes each of the seven steps as they are applied to monitoring at the OD Unit. The SAP will further explain and address each of the seven DQO steps.

Table C.1-1

Data Quality Objectives

Step 1. State the Problem to Be Resolved Residuals from detonation events may be present at levels greater than background or risk-based concentrations (RBCs).
Step 2. Identify the Decision Determine whether constituents exist at levels greater than background or RBCs.
Step 3. Identify the Inputs to the Decision Chemical analyses for explosive residues and metal constituents using U.S. EPA methods SW8330 and 6010 (except for Mercury by 74710), respectively. Risk based concentrations (RBCs) and background constituent concentrations as action levels.
Step 4. Define the Boundaries of the Study The OD Unit, divided into three distinct populations, or strata. Strata definitions are based on the volume of detonation ejecta received and the natural boundaries of the site.
Step 5. Develop a Decision Rule A. If concentrations in any of the strata are statistically different than background concentrations or RBCs, further evaluation will occur. Further evaluation may include additional sampling, site-specific risk assessment, or remediation. B. If average concentrations in Stratum C are significantly different than background concentrations or RBCs, the boundaries of the study will be revised to include a Stratum D.
Step 6. Specify the Acceptable Uncertainty Limits The uncertainty in the average concentration of a stratum is targeted to be plus or minus 100% of the average concentration and is achievable with four samples per strata. The uncertainty in comparing strata averages to the background average is a minimum detectable relative difference of 120% with an alpha error of 20%.
Step 7. Optimize the Design for Obtaining the Data Collect four discrete samples from each of the strata. Samples will be randomly selected from a pre-determined grid. Within each stratum, sampling depth will vary based on the estimated thickness of impacted soil.

1.4 Organization of this SAP

The SAP has been organized to address each of the data quality objectives in a manner that is useful for sampling at the OD Unit. Section 2 contains physical descriptions of the site and background geologic information. The three types of sampling, background, operations, and closure, are discussed in Sections 3, 4, and 5, respectively. Requirements that are independent of the type of sampling are provided in Sections 6 through 8 and cover sample handling and chain of custody (COC), documentation activities, laboratory analysis. The data evaluation methods including use of the decision criteria and remedial alternatives are described in Section 9, Data Evaluation methods.

2.0 SITE DESCRIPTION

The following section summarizes the site location, unit operations and geologic setting at the 20,000-Pound OD Unit. The OD Unit, as well as the environmental conditions, including geology, hydrogeology, topographic and drainage features, and climate at Holloman AFB, is described in detail in Sections B and E of the permit application. Section D of the permit application describes the OD Unit's operation in detail.

2.1 Site Location

The 20,000-Pound OD Unit is within the boundaries of Holloman AFB in Otero County, New Mexico, approximately 7 miles west of Alamogordo, New Mexico. The location of Holloman AFB and the exact location of the OD Unit are shown in Section B of the permit application, Figures B-1 through B-4.

The OD Unit is located approximately 1000 ft within the northern boundary of Holloman AFB. White Sands Missile Range lies to the north and west of the adjacent base boundaries. All lands within Holloman AFB boundaries are under the control of the U.S. Air Force. Thus, the unit is surrounded by access-controlled Federal lands for a distance of several miles in all directions. Figure B-4 of the permit application shows the land use immediately surrounding the OD Unit. The unit is situated on undeveloped grassland near areas of barren land (dunes) and arroyos and is isolated from commercial and residential land uses. The closest building to the OD Unit, on or off the Facility, is approximately 4000 ft from the OD Unit.

The 20,000-Pound OD Unit itself is a demarcated octagonal area approximately 400 ft in diameter and is devoid of vegetation, rocks, and debris. The portion of the OD Unit that is used for detonations is confined to a 100-ft diameter area in the center of the larger cleared area. Access to the OD Unit is provided by a single paved road that terminates at the end of the Test Track. A dirt road, approximately one-quarter mile long, is used for access from the paved road to the OD Unit.

2.2 OD Unit Operations

As a result of Air Combat Command (ACC) readiness requirements and the Holloman AFBs 46th Test Group activities, a variety of ordnance, munitions, incendiaries, and propellants become waste because of exceedence of shelf-life, unanticipated deterioration, or failure to attain specifications that render the device non-serviceable. Rocket motors that exceed 300 lbs are also treated at the 20,000-Pound Open Detonation Unit.

The 20,000-Pound OD Unit consists of a clear zone approximately 400 feet in diameter. Treatment of the wastes is accomplished by placing the explosive ordnance on top of the ground within a 100-ft diameter area at the center of the clear zone. The waste is then treated by detonation. The force of the explosion often creates a depression in the ground, which is inspected to ensure that the waste has been completely destroyed. Metallic debris ejected outside of the depression are collected immediately after each detonation and taken to the DRMO for recycling. Unexploded material with residual ordinance is returned to the depression and redetonated. Subsequent detonations are performed at locations within the 100-ft diameter detonation area. Following each detonation event, a bulldozer fills in the depression caused by the detonation. Although the exact number of treatment events that occur during any year is variable, discrete treatment events typically occur once per month. A drawing of the area, showing dimensions of the unit, is provided in Figure C.1-1.

Figure C.1-1. Unit Drawing of the 20,000-Pound OD Unit

2.3 Geologic Setting

Holloman AFB is located within the northern Chihuahuan Desert, in the region known as the Tularosa Basin. The basin is approximately 120 miles long and bounded 8 miles to the east by the Sacramento Mountains and 20 miles to the west by the San Andres Mountains. The basin was formed when the surrounding mountains were uplifted, creating an elongated, faulted valley known as a graben. Elevations within the Tularosa Basin range from 4400 feet above mean sea level (MSL) at the northeast corner to 4000 feet MSL in the southwest corner. The OD Unit is located down slope of the Sacramento Mountains at an approximate elevation of 4100 feet MSL.

Figure C.1-2 shows a geologic cross section at the OD Unit. An analysis of the cross section shows a uniform near-surface lithologic sequence with a slight change in depositional environments across the OD Unit at depth. Eolian deposits comprise the upper 10 feet and are predominantly interdune deposits consisting of fine sand and silt. A three to five foot thick layer of silt and clay (playa in origin) underlies the uppermost eolian deposits. Below 30 feet the geologic interpretation becomes more complex. The geologic logs show lithologic changes across the site between silty clay, silty sand, and sand at the downgradient wells (HAFB/EOD-MW-02, 03, and 04). Meanwhile, the upgradient well (HAFB/EOD-MW01) shows massive silty clay with stringers or lenses of sand. It is highly probable that these sand zones are interconnected. Groundwater is encountered at approximately 30 ft below ground surface.

Figure C.1-2. Geologic Cross Section of the 20,000-Pound OD Unit Site

3.0 BACKGROUND SAMPLING METHODOLOGY

Prior to the first quarterly sampling event, surface soil samples will be collected around the OD Unit to establish background concentrations of metal and explosive constituents to be used in future comparisons. Background samples are intended to be representative of metal and explosive constituent levels in unaffected soils of similar type in the vicinity of the OD Unit. The sample selection procedures and sampling methodology specific to background sampling are provided below. Information that applies to both background and operational monitoring sampling (decontamination procedures, health and safety requirements, laboratory specifications, sample handling and COC, etc.) is contained in Sections 6 through 8.

3.1 Sampling Location Selection

Six background locations will be located at a distance between 500 and 1000 ft from the edge of the OD Unit in soil of similar lithology as within the OD Unit. Samples will not be collected at any location where surface soils appear to be disturbed or near to other contaminant source areas. Figure C.1-3 shows the location of other sites at Holloman AFB that may potentially contain hazardous constituents. The closest installation restoration program (IRP) site, or RCRA solid waste management unit (SWMU) is over three miles from the 20,000-Pound OD Unit to the south.

Because visual inspection of the surface soil is necessary in order to obtain a background sample of similar lithology to that of the 20,000-Pound OD Unit, the exact sampling locations will be determined during sampling. The inset on Figure C.1-3, however, shows the area from which background samples will be collected and six potential sampling locations. Samples will be situated as closely as possible to these six locations during the background sampling round. The exact location of each sample will

Figure C.1-3. Location of the 20,000-Pound OD Unit in relation to SWMU and IRP Sites at Holloman AFB

be measured from the boundary markers at the 20,000-Pound OD Unit and plotted on a site map. Following sampling, each location will be marked with wooden stake and labeled with the background location identification number.

3.2 Required Equipment and Sampling Methodology

Required sampling equipment includes a hand-powered soil auger for excavation, containers consisting of 100- to 500-mL glass bottles, plastic caps, a small stainless steel or Teflon-lined trowel, small stainless steel or Teflon-lined spatulas/scoops/spoons, and adhesive labels for sample identification. Sampling procedures will be performed in accordance with American Society for Testing and Materials (ASTM) D 1452, "Standard Practice for Soil Investigation and Sampling by Auger Borings," where applicable.

Background samples will be collected by initially advancing the hand auger the length of the bucket (approximately 3 to 6 in.) into the soil. The sample will then be removed from the auger and placed in a stainless steel bowl. The auger will then be inserted back into the hole and advanced. This procedure will be repeated until the auger reaches a depth of 6 inches. At this point, the collected soil will be homogenized in the bowl using the spatulas or spoons described above. Appropriate quantities of the soil will be transferred to the sample containers for analysis. (Refer to Section 6 for sample handling and chain-of-custody procedures.)

Appropriate sampling information (date, time, sample number, etc.) and observations about the sample location will be recorded in the field logbook. Sampling equipment will be cleaned according to the decontamination procedures described in Section 6.1 of the SAP. Clean sampling equipment will be used at each sampling location. Field logbooks and COC forms will be completed in accordance with Section 6 and 7 of this SAP.

3.3 Chemical Analyses

This section summarizes the analytical procedures that will be followed for site-specific characterization of background constituent concentrations. Soil samples will be analyzed for toxic metals, including priority pollutant metals (listed in the New Mexico

Hazardous Waste Management Regulations-7, Part V, Appendix IX), explosive residues, and soil moisture. Table C.1-2 lists all analytes that will be measured along with their EPA SW-846 test method. Analytical requirements are discussed further in Section 7. The rationale for selecting the analyte list in Table C.1-2 is provided in detail in Section C of the Permit Application and Section 4.5 below.

An important consideration for the site-specific background study is the specification of uncensored data for all sampling results. As specified in Section 8 of this SAP, the contracted laboratory will be required to report uncensored data. Often, numerical measurement results below a specified concentration are reported with a qualitative descriptor such as "not detected" or "less than" rather than as a numerical value. This practice, called censoring, complicates statistical analyses and data interpretation because an important part of the information about measurement variability is unavailable for consideration. This introduces another source of uncertainty in estimates derived from censored data sets. Uncensored data will be used for this study to preserve all available information in the data about the natural variability of measurements of background concentrations.

3.4 Quality Control Samples

Quality control (QC) samples will be collected during the background sampling round to assess the accuracy and precision of the site-specific background results. QC samples will be collected using the same frequency and methodology as described in Section 4.6 below. Section 4.6 addresses the specific requirements for QC sampling during the operational sampling at the OD Unit. Because six background samples will be

Table C.1-2

Analytical Methods for Soil Samples

Parameter/ Constituent	EPA Hazardous Waste Number	Test Method	Reference
Explosive Compounds	D003	8330	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
HMX RDX 1,3,5-Trinitrobenzene (TNB) 1,3-Dinitrobenzene (DNB) Tetryl Nitrobenzene(NB) Nitroglycerine 2,4,6-TNT 2,4-DNT 2,6-DNT 2-Nitrotoluene (NT) 3-NT 4-NT			
Toxic Metals			Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
Antimony	--	6010	
Arsenic	D004	6010	
Barium	--	6010	
Beryllium	--	6010	
Cadmium	D006	6010	
Chromium	D007	6010	
Copper	--	6010	
Lead	D008	6010	
Mercury	D009	7471	
Nickel	--	6010	
Selenium	D010	6010	
Silver	D011	6010	
Soil Moisture	--	3550	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).

taken, one field duplicate and one matrix spike(MS)/matrix spike duplicate (MSD) pair will be required. The QC data evaluation will follow the EPA Level III methods described in Section 8 of this SAP.

3.5 Statistical Methodology for Calculating Background Concentrations

The approach that will be used for the statistical characterization of background is summarized as follows:

- Evaluate method blanks to characterize laboratory system "noise";
- Evaluate matrix spikes for potential bias in measurements;
- Evaluate background data for outliers and other abnormalities;
- Compare blank results to background results to determine if analytical method sufficient to resolve native concentrations; and
- If native concentrations can be resolved, calculate summary statistics for use in background comparisons (e.g., average, standard deviation, warning limit, upper tolerance limit (UTL), etc.); or
- If native concentrations cannot be resolved, report "Background Not Detectable" and determine how this impacts project objectives.

The statistical methodology is explained in more detail in the remainder of this section.

3.5.1 Outlier Testing and Graphical Data Review

After evaluating quality control samples (method blanks to assess laboratory background noise and matrix spike/matrix spike duplicate samples to evaluate potential biases in the data), the first steps in the statistical data analysis will be to conduct outlier tests to identify anomalous measurement results and to review histograms of the raw measurement data. The fourth-spread outlier test (Hoaglin, Mosteller, and Tukey; 1983) will be used to determine if any individual results are statistically different from the rest of the sample population for both background and blanks. Field and laboratory log books will be reviewed for each potential outlier to determine whether causes could be

identified that would support discarding the outlier from the original data set. Throughout the outlier test process, histograms will be reviewed to confirm that the measurements used in subsequent analyses are reasonable representations of the background and blank populations.

3.5.2 Comparison of Background Results with Blank Results

Background data will then be compared with laboratory blank data to determine if the data sets can be resolved (i.e., background results can be distinguished statistically from analytical background). A statistical test known as the Kolmogorov-Smirnov test (SAS, 1989) will be used, together with the graphical data review described above, to assess the comparability of blank and background results for each of analytes of interest.

3.5.3 Normality Testing and Calculation of Summary Statistics

Before upper tolerance limits (UTLs) can be calculated the background data set will be evaluated to see if the data appear to be normally distributed. The assumption of normality is a fundamental tenet of statistical tests involving parametric methods. Therefore, the extent to which the data support this assumption determine the direction of the subsequent analyses. A statistical test known as the Shapiro-Wilk *W* test (Shapiro and Wilk, 1965) will be used to test the results for normality.

To summarize the normality testing, tables will be prepared that include the minimum and maximum measured concentrations, as well as estimates of the mean, median, and standard deviation. If results of the Shapiro-Wilk test show that the assumption of normality is not appropriate for some analytes, the summary statistics tables will also include a value for F-pseudosigma, which is a nonparametric measure of dispersion. (The standard deviation is the analogous parametric measure of dispersion.)

3.5.4 Calculation of Warning Limits and UTLs

The results of the Shapiro-Wilk tests will be used to determine whether parametric or nonparametric statistical methods are most appropriate for calculating the warning limits and UTLs. Parametric methods will be used when the population is

known or can be assumed to follow a normal distirbution. They can also be used when the population of interest can be modeled by some other distribution (such as the log normal) that allows the measurement data to be transformed to a normal distribution. For the analytes where the Shapiro-Wilk tests did not indicate a significant departure from normaility, a parametric UTL for 95% coverage with a 95% confidence will be calculated using EPA methodology (U.S. EPA, 1992). This will represent an upper 95% confidence bound for the 95th percentile concentration. The normal UTL is calculated using the following equation:

$$UTL = \underline{x} + (K \times s)$$

where $\underline{x}$ is the estimated sample mean, K is the tolerance factor, and s is the estimated standard deviation. The tolerance factor, K, can be found in the tabulated form in Tables A.12 of Hahn and Meeker, 1991.

For those cases in which the Shapiro-Wilk tests indicates significant departure from normality, the second step will be to see if a log transformation can be used to produce a more normally distributed data set. Natural logarithms of the results will be taken, and the Shapiro-Wilks test will be repeated on the transformed data set.

If logarithmic transformations do not produce a more normally distributed data set, nonparametric methods will be used to calculate a UTL. Nonparametric methods are not based on the assumption of normality, and are sometimes referred to as distribution-free methods. If nonparametric methods are required, the most appropriate and current statistical methodology will be followed and provided to NMED with the background study results.

4.0 OPERATIONS SAMPLING METHODOLOGY

4.1 Sampling Approach

A stratified random discrete sampling approach has been chosen for quarterly operations sampling at the OD Unit because of the unique contaminant distribution associated with detonation sites. The sampling strategy chosen for the OD Unit differs from a simple random sampling procedure, which is employed at other hazardous waste sites, because concentrations of contaminants are stratified horizontally. That is, the concentration of potential contaminants is greater and most variable at the detonation center and decreases with distance away from the detonation center. This approach provides two advantages over simple random sampling:

1. The data should be more homogenous within each stratum than in the population as a whole; and

2. Separate estimates of population parameters can be obtained for each stratum without additional sampling.

In general, a stratified random sample is obtained by separating a population into non-overlapping groups, called strata, and then selecting a discrete simple random sample from each stratum. In the case of the 20,000-Pound OD Unit, the "population" to be sampled is the potentially affected surface soils in the vicinity of the OD Unit. The term "strata," used in this context, refers to discrete horizontal zones of surface soil, not vertical geologic strata.

Initially, sampling locations will include the area where the unexploded ordnance is placed for destruction and all areas within OD Unit. The OD area will be divided into three strata for sampling purposes: (1) Stratum A, (2) Stratum B, and (3) Stratum C. As described further in Section 9, Data Evaluation, samples may also be collected from a Stratum D if concentrations in Strata C are found to exceed the decision criteria. The strata are described in the next section.

4.2 Sampling Strata Descriptions

For sampling purposes, the OD Unit will be divided into three strata, each selected to possess a normal contaminant distribution. As described further in this section, sampling weighted by the wind direction at detonation events provide the most conservative measure of potential constituents. Prevailing wind direction will be determined for each detonation episode from the Holloman AFB weather station to ensure that proper sampling locations are chosen following detonation. Table C.1-3 describes each strata, the expected distribution of residuals, the number of discrete samples to be collected, and the rationale for the chosen sampling depths. The strata are shown in plan view in Figure C.1-4 and in cross-sectional view in Figure C.1-5. The stratum are also described below.

Stratum A: Depression left by detonation—Stratum A includes the depression created from the detonation event. It is assumed that this area possesses a normal contaminant distribution and is representative of soil directly affected by detonation events.

Stratum B: Depression to Edge of Detonation Area—Stratum B is the intermediate zone between Stratum A and the edge of the active detonation area. (Because a given detonation may be situated anywhere within the 100-ft diameter detonation area, the maximum distance from the most recent detonation pit could be 100 ft.) It is assumed that this area possesses a normal contaminant distribution. It will contain fallout close to the detonation and may contain areas previously used for detonation that have since been backfilled.

Table C.1-3. Sample Location Depth and Rationale

Figure C.1-4. Sampling Strata and Potential Random Sampling Locations

Figure C.1-5. Cross-Sectional View of OD Unit and Strata

Due to prevailing wind direction, higher concentrations of contaminants could exist in a downwind direction. To compensate for this possibility, the prevailing wind direction will be noted for each detonation period. It is assumed that the area 45º on either side of the prevailing wind direction at the time of detonation will be the most contaminated. Therefore, samples will be collected in this area to produce a more conservative estimate of residual concentration in the soil. Because multiple detonation events may occur between sampling events, wind direction from all detonation events prior to sampling will be considered. Figure C.1-6 demonstrates how the wind direction will be accounted for in determining the strata. In the example, the three detonations prior to sampling had wind directions varying from northeast to southeast. For each detonation, lines 45º on either side of the wind direction were drawn. Prior to sampling, the angles furthest northeast and southeast were used to create a composite strata diagram for sampling.

Stratum C: Edge of the Detonation Area to OD Unit Boundary—Stratum C is designated as the outer zone situated from the edge of the detonation area to the OD Unit boundary. It is assumed that this area also possesses a normal contaminant distribution, consisting only of fallout from the detonation event. Because no detonations take place in this stratum it is considered distinct from Stratum B.

Similar to Stratum B, higher concentrations of contaminants could exist downwind in Stratum C. To compensate for this possibility, it also will be assumed that the area 45º on either side of the prevailing wind direction at each detonation will be the most contaminated. Using the method described above, the shape of Strata C will be determined.

Figure C.1-6. Determination of Strata Geometry Using Wind Direction from Previous Sampling Events.

Stratum D: OD Unit Boundary to 150 ft outside of OD Unit—Because all ejecta outside of the OD Unit is collected immediately after each detonation and, therefore, the likelihood of leaching to the soil is extremely small, no sampling is planned for Stratum D. A Stratum D will only be used in the event that constituent levels within Stratum C exceed decision criteria. If it is necessary to sample from a Stratum D, the outer boundary of the Stratum will be placed the same distance away from Stratum C as Stratum C is from B. That is, 150 ft from the edge of the OD Unit. This Stratum, however, is for determining constituent concentrations and will not be considered a new boundary for the 20,000-Pound OD Unit.

4.3 Sampling Frequency

Soil sampling will occur quarterly to demonstrate that the OD treatment activities are being performed properly and that residual waste constituents are not contaminating soils above risk-based levels or background concentrations. The operational monitoring sampling must occur within two weeks after a detonation and no site work (backfill, excavation, or construction) will be performed during the time between the last detonation event and the sampling.

After several rounds of quarterly sampling, Holloman AFB will re-evaluate the frequency of operational monitoring sampling. If the data indicate that a reduced sampling frequency (such as annual) is warranted, Holloman AFB will submit a request and justification to New Mexico Environment Department (NMED) to modify the quarterly sampling requirements. Only upon approval by NMED may an alternate sampling frequency be implemented.

4.4 Sampling Methodology

4.4.1 Initial Procedures

Before samples are collected, the strata and random sampling locations will be determined. The four random sample locations will be selected from within each stratum using the following procedure:

1. **Delineate Strata:** Prior to the sampling event, the detonation center from the most recent detonation event will be located. The detonation center will be used to determine the exact position of the three strata for that sampling event. Using the strata definitions in Section 4.2, the three strata will be delineated based on prior wind directions and the specified unit dimensions.

2. **Select Random Sampling Locations:** Using the dimensions of the strata, a grid will be placed across each of the strata as shown in Figure C.1-4. The grid will be of sufficient spacing so that each stratum includes four to six times as many potential sampling locations as the number of samples to be collected (four per strata). Each grid node will then be numbered sequentially from zero (e.g., A0, A1, A2..A28; B0, B1, etc.). To determine the location of each sample, a random number will be generated from 0 to 1. The random number will then be scaled to the range of possible grid nodes. The result rounded to the nearest integer is the grid location to be sampled. Table C.1-4 illustrates an example of selecting four random samples for stratum C.

Table C.1-4
Example Calculation of Random Sampling Location Selection

Stratum:C
Number of Samples:4
Number of Potential Sampling Locations:N = 24
Scale Factor:SF = N - 1 = 23

Formula: Grid Node = Random Number * Scale Factor
(round to nearest integer using standard rounding conventions)

Sample Number	Random Number[1]	Scaled Random Number	Grid Node to Sample
1	0.11356	2.61	C3
2	0.78543	18.06	C18
3	0.46786	10.76	C11
4	0.91002	20.93	C21

[1]The random number can be generated using a scientific calculator or spreadsheet.

4.4.1 Required Sampling Equipment and Collection Procedures

Required sampling equipment includes a hand-powered soil auger for excavation, containers consisting of 100- to 500-mL glass bottles, plastic caps, a small stainless steel or Teflon-lined trowel, small stainless steel or Teflon-lined spatulas/scoops/spoons, and adhesive labels for sample identification. Sampling procedures will be performed in accordance with American Society for Testing and Materials (ASTM) D 1452, “Standard Practice for Soil Investigation and Sampling by Auger Borings,” where applicable.

In general, samples will be collected by initially advancing the hand auger the length of the bucket (approximately 3 to 6 in.) into the soil. The sample will then be removed from the auger and placed in a stainless steel bowl. The auger will then be inserted back into the hole and advanced. This procedure will be repeated until the

desired depth for the stratum has been reached (refer to Table C.1-3). (For Stratum C, where the desired sampling depth is 0 to 2 inches, the auger will be advanced only 2 inches into the soil). At this point, the collected soil should be homogenized in the bowl using the spatulas or spoons described above. Appropriate quantities of the soil will be transferred to the sample containers for analysis. (Refer to Section 6 for sample handling and chain-of-custody procedures.)

Appropriate sampling information (date, time, sample number, etc.) and observations about the sample location will be recorded in the field logbook. Sampling equipment will be cleaned according to the decontamination procedures described in Section 6.1 of the SAP. Clean sampling equipment will be used at each sampling location. Field logbooks and COC forms will be completed in accordance with Section 6 and 7 of this SAP.

At the completion of each quarterly sampling round, all sampling locations will be recorded on a drafted site map and taped into a bound sampling log. Sampling locations will be triangulated from specified boundary markers of the OD Unit. (Complete documentation procedures are described in Section 7.)

4.5 Chemical Analyses

This section summarizes the analytical procedures that will be followed for proper characterization of the 20,000-Pound OD Unit. Soil samples will be analyzed for toxic metals, including priority pollutant metals (listed in the New Mexico Hazardous Waste Management Regulations-7, Part V, Appendix IX), explosive residues, and soil moisture. Table C.1-5 lists all analytes that will be measured along with their EPA SW-846 test method. Analytical requirements are discussed further in Section 7.

The analytical test methods listed in Table C.1-5 were selected based on knowledge of the OD Unit's operational history. Holloman AFB has never been used for the research and development of nuclear, chemical warfare, or other exotic warfare types of weapons. The OD Unit is used solely for the disposal/treatment of conventional waste-ordnance, munitions, incendiaries, single- and double-based propellants, and rocket motors. The only munitions delivered or disposed of at Holloman AFB have been

conventional live and training munitions. Therefore, the chemical components and combustion by-products are consistent with what is typical for military munitions items; thus, the emphasis of sampling and analysis for the OD Unit should be to search only for the constituents present in these types of wastes.

This rationale is supported by the studies conducted to characterize emissions from thermal treatment of explosive munitions (the “Bang Box” studies conducted by Johnson et. al during 1991 and 1993). These studies included emissions analyses for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. Conclusions drawn from the emissions testing of selected ordnance found that VOCs were consistently detected at trace concentrations and that SVOCs were detected at approximately two orders of magnitude less than metals (which is the primary indicator and most persistent form of contamination). Together, this approach supports using the analytical methods described in Table C.1-5. Analysis for constituents not listed in Table C.1-5 should be considered only if the mission of Holloman AFB or the operation of the OD Unit changes.

Table C.1-5

Analytical Methods for Soil Samples

Parameter/ Constituent	EPA Hazardous Waste Number	Test Method	Reference
Explosive Compounds	D003	8330	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
HMX RDX 1,3,5-Trinitrobenzene (TNB) 1,3-Dinitrobenzene (DNB) Tetryl Nitrobenzene(NB) Nitroglycerine 2,4,6-TNT 2,4-DNT 2,6-DNT 2-Nitrotoluene (NT) 3-NT 4-NT			
Toxic Metals			Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
Antimony	--	6010	
Arsenic	D004	6010	
Barium	--	6010	
Beryllium	--	6010	
Cadmium	D006	6010	
Chromium	D007	6010	
Copper	--	6010	
Lead	D008	6010	
Mercury	D009	7471	
Nickel	--	6010	
Selenium	D010	6010	
Silver	D011	6010	
Soil Moisture	--	3550	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).

4.6 Quality Control Samples

This section addresses requirements for field QC samples. Quality control in the field begins with adherence to the specified sampling protocols (see Section 4.4), but is monitored by a variety of samples taken with sufficient frequency to test the quality of measurement results. To measure field related components of qualilty (i.e., versus laboratory components), duplicates and matrix spike/matrix spike duplicate (MS/MSD) pairs will be collected. Refer to Table C.1-6 below for an explanation of the field QC requirements and procedures. Because no potential volatile or semi-volatile constituents are present, trip blanks and field blanks would not yield useful QC data and will not be collected.

Table C.1-6
QC Sample Requirements

Sample Type	Frequency[1]	Purpose	Method
Field Duplicate	10%[2]	To ensure sampling procedures are reproducible and that the sample is representative of the location.	Collect twice the normally required sample volume. Split the sample into two aliquots. Treat each portion as if it were a separate sample and submit for analysis.[3]
MS/MSD	1 pair per 20 samples; or minimum 1 per sampling event	Assess the efficiency of extraction, accuracy of the analysis, and possible matrix effects. The MSD assesses the precision at known concentrations.	Collect twice the normally required sample volume and specify MS/MSD analysis at laboratory.

[1]Standard rounding conventions will be used. For example, 10% of 14 samples equals 1 field duplicate; 10% of 15 samples equals 2 field duplicates, etc.

[2]Location will be selected from one of the three strata. A different location and strata will be selected for each sampling event.

[3] Analytical methods, sample container requirements, and holding times are listed in Table 5-1.

5.0 CLOSURE SAMPLING

In the event that the OD Unit is closed, a final round of sampling will be completed. This round of sampling will be conducted after the last detonation event, prior to any site work (grading, construction, landscaping, etc.). Because prior rounds of operational monitoring sampling will have been conducted during the operation of the 20,000-Pound OD Unit, additional sampling is not necessary and the closure sampling will be conducted in the same manner as the periodic operations sampling.

All procedures described in Section 4 above will be followed at the time of closure. Three strata will be used and their dimensions will be determined based on previous wind directions and the size of the Unit. Four samples will be collected from each stratum at randomly selected grid points. Samples will be collected from the depths indicated in Table C.1-3 and analyzed for explosive residues and metals listed in Table C.1-5. QA/QC procedures, documentation requirements, laboratory protocols, and all other requirements applicable to operations sampling will be followed for the closure sampling.

Because the Closure Plan (Section I of the Permit Application) may be modified during the life of the OD Unit's operating permit, the closure sampling protocols in this section will be modified, as necessary, in conjunction with changes made to the Closure Plan.

6.0 EQUIPMENT DECONTAMINATION, SAMPLE HANDLING, AND COC

6.1 Contamination Control Procedures

Sampling tools and equipment will be protected from contamination sources before sampling and decontaminated before and between sampling points. Sample containers will also be protected from contamination sources. Sampling personnel will wear clean chemical-resistant gloves when handling the sampling equipment and samples. Gloves will be decontaminated or disposed of between samples.

To prevent cross contamination, sampling equipment will be subject to decontamination procedures following each sample collected at each location. Sampling equipment will be decontaminated in a decontamination zone by being:

- Brush-scrubbed in tap water and Liquinox detergent wash in a tub to remove any soil from the equipment;
- Rinsed in tap water in a separate tub;
- Rinsed with deionized water;
- Rinsed with isopropanol;
- Air-dried in an area upwind of the decontamination process; and
- Stored for future sampling after being wrapped in aluminum foil (shiny side out).

In addition, sampling will first occur in those areas suspected as having the least contamination (Stratum C) and proceed to those areas suspected of having a greater possibility of contamination (Stratum A).

6.2 Personnel Requirements and Health and Safety Procedures

If deemed necessary, personnel performing sampling activities will use personal protective equipment such as rubber gloves, boots, aprons, Tyvek coveralls, and eye protection. Personnel will not be permitted to conduct any sampling until they have been cleared by EOD personnel and the high-speed test track security police.

Sampling personnel will be properly trained in hazardous waste sampling, and have a minimum of one year of sampling experience. Personnel will also have 40-hour 29 Code of Federal Regulations (CFR) 1910.120 Occupational Safety and Health Administration (OSHA) training and appropriate medical monitoring and certification. Sampling personnel will also be briefed by Holloman AFB EOD personnel on the hazards of sampling explosive compounds.

6.3 Chain of Custody Procedures

COC procedures will be followed to track possession of the samples from the time they are collected until the analytical data from the samples are received and recorded. For all soil samples, procedures will begin once sampling is complete. A sample will be considered under custody if it is:

- In the possession of the sampling team;
- In view of the sampling team;
- Placed in a secure area by the sampler; or
- Transferred to a secure area.

An area is considered secure only when it is locked and access is controlled. The sampling team leader is responsible for custody of the collected samples in the field until they have been properly transferred to the shipping coordinator, who is responsible for sample custody until the samples are properly packaged, documented, and released to a courier or directly to the analytical laboratory. A triplicate COC record form will be used for the sampling effort.

6.4 Sample Container and Preservation Requirements

Samples will be collected in pre-cleaned sampling containers and will be kept cold during transportation and shipping. Table C.1-7 summarizes the containers, preservative, and holding time requirements for the samples to be collected. Laboratory-

specific container requirements should be verified with the contracted analytical laboratory prior to sample collection.

Table C.1-7

Summary of Sample Container, Preservative, and Holding Time Requirements for Soil Samples

SW 846 Method	Analyte	Container	Preservative	Holding Time
6010	Metals (As, Sb, Ba, Be, Cd, Cr, Cu, Pb, Ni, Ag, Se)	500-mL wide-mouthed glass or plastic jar	None, cool, 4ºC	6 months for digestion and analysis except for mercury which must be digested and analyzed in 28 days.
7471	Mercury			
8330	Explosive residues	500-mL wide-mouthed glass jar with Teflon-lined cap	None, cool 4ºC	14 days to extraction 40 days after extraction

6.5 Packaging and Transportation

At the end of each sampling day, samples will be packaged in shipping containers with double-bagged ice packs to maintain a temperature of less than 4°C. The samples will be carefully packaged so that they will not break during shipping and will contain absorbent material capable of containing all liquid. Each shipping container will be sealed with custody seals and shipped to the analytical laboratory by an overnight delivery service.

7.0 DOCUMENTATION OF ACTIVITIES

7.1 Sample Identification

Sample containers will be uniquely identified to indicate the site, the individual composite sample's location, the treatment unit, and date. Examples of a sample code for the three sampling zones are listed below:

- 20K-A01-110595 (OD Unit sample number 01 taken within Stratum A on November 5, 1995);
- 20K-B01-110595 (sample number 01 from Stratum B of the OD Unit taken on November 5, 1995); and
- 20K-C01-110595 (sample number 01 from Stratum C of the OD Unit taken on November 5, 1995).

Sample locations will be triangulated from existing OD Unit boundary markers so that the exact location can be determined if necessary. This information will be recorded in the field sampling book.

7.2 Sample Labels

The samples collected will be identified by an adhesive label containing the following information:

- Collector's initials;
- Sample ID;
- Analytical methods requested;
- Place of collection (facility and location);
- Date sample taken; and
- Time sample taken.

Any other information required by the laboratory or deemed necessary by project personnel will also be added to the label.

7.3 Field Sampling and Unit Operation Logbooks

All the methodology, procedures, and events pertaining to sample and data acquisition will be recorded in bound, water-resistant field logbooks with a black waterproof ink pen. The logbooks will be considered formal documents representing a complete and organized record of all field activities. The entries will include, but not be limited to the following:

- Personnel present; name of sampler(s);
- Date and time of every recording;
- Work location;
- Description of work and treatment process;
- Purpose of sampling;
- Soil sample descriptions;
- Description and location of area sampled;
- Sample numbers;
- Field QC data;
- Other important notes on field activities, conditions, or problems; and
- Initials/signature of person entering data.

Entries made in the logbook should be of sufficient detail to reconstruct the taking of a sample by the reading of the entries and information recorded in it. No erasures or deletion marks are permitted. If a mistake is made in a logbook, it must be corrected by marking a line through the error and initialing. The correction may be made in space available on the page.

8.0 LABORATORY ANALYSIS

8.1 Laboratory Specifications

Design and execution of the testing program will be coordinated with an analytical chemist experienced in contaminated soil testing. The laboratory procedures and QA/QC specifications will follow those set forth in the Quality Assurance Project Plans (QAPP) for the 300-Pound Open Burn Area as presented in the 300-Pound Open Burn Area Closure Plan (Radian, 1995). The following is a summary of these laboratory specifications and procedures.

At a minimum, the laboratory report will state the following:

- Unique laboratory ID;
- Field sample ID;
- Sampling date;
- Preparation date;
- Analysis date;
- Preparation batch;
- Preparation method;
- Analysis batch;
- Analysis method;
- Analyte;
- Results;
- Footnotes;
- Units;
- Sample matrix;
- Sample-specific detection limit;
- Dilution factor;
- Matrix spike recoveries;
- Surrogate spike recoveries (for all samples, blanks, and laboratory QC samples);
- Case narrative (if necessary);
- Dry weight;
- Blank sample results; and
- Laboratory control sample results.

SW-846 addresses all procedures proposed in this SAP. The laboratory will be required to achieve the required or estimated detection limits as specified in SW-846. If equivalent methods are used, this must be justified in advance. Approval for any equivalent

methods employed by the laboratory will be at the discretion of Holloman AFB and New Mexico Environment Department (NMED).

Soil samples will also be analyzed for soil moisture content, in accordance with SW-846.

The contracted laboratory will report uncensored data for all analytical results. Regardless of the analytical measurement result, it will be reported without qualitative descriptors such as "not detected," "less than," etc.

8.2 QA/QC Protocols

For all inorganic tests, the samples will be spiked with known quantities of the hazardous constituent and spike concentration and percent recovery (PR) reported. For organic tests, the samples may be spiked with a subset of target analytes. The surrogate spike recoveries will be reported for all organic tests. Results from method blanks on the samples will be submitted. Blank results will not be subtracted. The method of how the reported lower detectable limit was determined must also be reported. To ensure that the established data quality objectives (DQOs) can be attained, the level of analytical quality achieved will be at least Level III. Data will be sufficiently documented to allow personnel to review and evaluate data quality and have all reporting requirements to achieve Level III data quality. Level III data will allow Holloman AFB to determine whether, based on the results, the OD treatment process is affecting the environment.

As a quality assurance measure, the contracted laboratory will also be required to participate in the U.S. EPA Water Pollution (WP) and Water Supply (WS) studies which include blinded performance evaluation samples.

8.3 Measurement Quality Indicators

DQOs are quantitative and qualitative statements specified to ensure that data of known and appropriate quality are obtained during sampling. The overall objective of sampling is to provide an accurate, precise, and representative confirmation that the OD Unit

treatment process is not contaminating surrounding soils above risk-based levels or background levels. DQOs will be followed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC). The PARCC parameters indicate measurement data quality. The procedures described in this section are designed to obtain PARCC for each sampling and analytical method and analysis. The PARCC parameters will be evaluated after each round of sampling.

8.3.1 Precision

Precision is a measure of variability between duplicate or replicate analyses, and is calculated for field and laboratory replicates. By definition, field or total, precision incorporates laboratory precision. Precision is calculated as the relative percent difference (RPD) between duplicate samples or analyses, or matrix spike/matrix spike duplicates as appropriate. The calculated RPDs are compared to the objectives stated in the method. Results that do not satisfy the objectives are assigned a data qualifier flag indicating uncertainty associated with imprecision.

An average RPD may be calculated and reported as a measure of overall analytical precision for compounds with multiple measurements. The specific samples collected or analyzed in duplicate are flagged if they do not satisfy the QA objectives. In addition, associated samples may be flagged to indicate variability due to poor precision. For poor field duplicate precision, samples collected by the same sampling team, from the same equipment, or on the same day may be affected; close evaluation of those results should indicate the most likely source of variability, and the corresponding samples will be qualified as warranted. For poor laboratory precision, samples processed and analyzed in the same batch will be more closely evaluated, and any anomalous result will be qualified.

The QA coordinator is responsible for ensuring that data qualifier flags are assigned to the data as required by the established QC criteria, and that they are reported and understood by project staff using the data for specific applications. The QA coordinator is also responsible for initiating corrective actions for analytical problems identified during the QC data assessment process. These corrective actions range from verifying that the method was in statistical control during the analytical runs, to re-analysis of the sample, or resampling.

8.3.2 Accuracy

Accuracy is associated with correctness, and is a comparison between a measured value and a known, or 'true' value. Accuracy is calculated from method spike (spikes of the pure matrix) matrix spike, or Laboratory Check Sample results.

Spike results are reported by the laboratory as percent recovery and are compared to the accuracy objectives stated in the method. Results that do not satisfy the objectives are assigned a data qualifier flag to indicate uncertainty associated with inaccuracy.

Method spikes are spikes of a reference material into a water matrix. If recovery is outside the established limits, samples from the same extraction batch may be qualified. Matrix spike results are generally more sample-specific. If matrix spike recovery is outside the established limits, results for samples collected from similar conditions and/or handled in the same batch will be examined. If any results appear atypical and could be related, those results may also be qualified. The flagged data will be discussed in the QA/QC report for the sampling task, and specific limitations such as poor or enhanced recovery for specific compounds will be stated. Further investigation or corrective action may be taken to find methods to reduce the interferences.

Surrogate spike results are also reported and used to assess recovery of target analytes on a sample by sample basis and provide a measure of system performance. Surrogate spike recoveries are compared to recovery limits. Any results outside the limits are flagged on laboratory reports and in the database. Any corrective action taken in the laboratory is documented in laboratory performance records and/or discussed in the comment section of the data report.

Confidence intervals can be calculated for an analytical method if performance evaluation samples are submitted or a series of method spikes is analyzed. The results are used to define confidence intervals for the recovery of each compound analyzed.

8.3.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criterion is satisfied by carefully selecting sample locations, sampling techniques, and analytical techniques and collecting a sufficient number of samples. Adherence to this SAP will ensure that sufficient representativeness has been achieved.

8.3.4 Completeness

Completeness is calculated after the QC data have been evaluated, and the results applied to the measurement data. In addition to results identified as being outside of the QC limits established for the method, broken or spilled samples, or samples that could not be analyzed for any other reason are included in the assessment of completeness. Analytical results for methods or analytes outside the established QC limits are considered questionable and are unusable for the RI and risk assessment. These results will be considered invalid and will be flagged with an "R". The percentage of valid results is reported as completeness.

Completeness will be calculated as follows:

Install Equation Editor and double-
click here to view equation.

where: T = Total number of expected measurements for a method and matrix;
I = Number of invalidated results for a method and matrix; and

NC =Number of results not collected (e.g., bottles broken etc.) for a method and a matrix.

8.3.5 Comparability

Comparability reflects the confidence with which data sets can be compared to each other. This is accomplished through use of standard sampling techniques for all sampling events and standard analyzing techniques for all samples. Comparability is limited to the precision and accuracy parameters of PARCC, because only when these parameters are known can data sets be compared with confidence.

8.4 Blank Data Assessment

Reagent blank results indicate whether any of the contaminants reported in sample results may be attributed to laboratory sources (reagents, glassware, instrumentation) and were not likely present in the sampled medium. The most common laboratory contaminants are methylene chloride, phthalate, acetone, and toluene; these are recognized as being ubiquitous in the laboratory environment and controlling them to within acceptable low levels is part of standard laboratory procedures.

If contamination from these compounds is reported in reagent blanks, the samples associated with the blank, either the same analytical or extraction batch, may be qualified to indicate that some or all of these compounds may be from laboratory sources. If the concentrations reported in the samples are similar to the blank concentrations, it is likely that all of the contamination was introduced, and this assessment is made in the QA/QC report for the sampling task.

In some cases, where there is a large sampling task and reagent blank results indicate a more significant contamination problem, a more systematic approach may be applied. This approach is only used when a series of reagent blanks analyzed over a period of time are reported. The assessment criterion is calculated from reagent blank results as the mean concentration plus three standard deviations for each contaminant reported. The sample data are assessed using this criterion. Sample concentrations below the criterion are considered to be most likely from laboratory sources, and at least some of the sample concentrations higher

than that are considered to be from the sampled medium. This semi-quantitative approach is used only as a tool to screen the sample results and provide a common basis for further assessment; none of the results are censored or changed in any way. The assessment is discussed in a QA summary report for the sampling task. Samples with blank contamination problems will be assigned a data qualifier flag.

8.5 Sample Return or Disposal

Unless directed otherwise by Holloman AFB, the laboratory will dispose of all soil samples following analysis. The laboratory will provide certification that its facilities qualify for the exemption in 40 CFR 261.4(d), which excludes waste samples from many hazardous waste management requirements. In addition, all laboratories will provide the base with an explanation of the disposal practices used with respect to sample residual.

9.0 DATA EVALUATION METHODS

To determine if operations at the 20,000-Pound OD Unit are adversely affecting soil at the site, the sampling results will be compared to site specific action levels. If constituent concentrations in the strata exceed action levels, further evaluation will be triggered. The following sections explain the action level determination, describe the comparison process, and list the potential remedial responses in the event of an exceedence.

9.1 Action Level Determination

The action levels for the potential contaminants at the OD Unit are derived from two sources: (1) the background upper tolerance limit (UTL), as calculated from the site-specific background sampling; and (2) calculated risk-based values. Section 3 of this SAP describes the methodology for calculating the UTL of background data. The UTL will be calculated using standard EPA statistical methods (EPA, 1992). Risk-based values will be calculated in accordance with the most current guidance and toxicity data.

9.2 Comparison of Sampling Results to Decision Criteria

All valid analytical data from sampling activities will be compared against the action levels to determine if a significant release of the targeted explosive and metal compounds has occurred (see Table C.1-5 for specific analytes). Results will first be compared to background UTLs and if an exeedence occurs, the concentration will then be compared against the risk-based concentration for that analyte. Every sample from each stratum will be compared individually to the action levels. To more fully understand the distribution of potential exceedences across a stratum, additional statistical tests may also be performed on a per-stratum basis.

Sampling results will be evaluated against actions levels after the analysis has been performed and the data has undergone QA/QC evaluation (typically 30 to 60 days from the time of sampling).

9.3 Data Resolution and Remedial Response

In the event that soil sampling results show that an action level has been exceeded at any sampling point, the sampling point will be immediately resampled to confirm the presence of contamination. If resampling confirms constituents concentrations in excess of the action level, the occurrence will be noted, NMED will be duly notified in writing, and a report describing the occurrence will be submitted to NMED within seven days of the sample confirmation.

For areas where contamination has been verified to exceed action levels, Holloman AFB, in accordance with NMED, may choose to further evaluate the exceedence using a site-specific risk-based approach, additional sampling results, or remediate affected soils. To prevent future contamination the OD Unit Operations will be reevaluated and modified, if appropriate.

Each of these potential solutions will require coordination with NMED and will be completed in a timely manner to help minimize the potential spread of contamination and risk to human health and the environment.

9.4 Determination of Stratum D

As indicated in Section 4.2, the SAP provides the provision for creating a Stratum D. Stratum D, which will consist of an area 150 ft outside of Stratum C, will only be sampled in the event of an exceedence in Stratum C. If sampling in Stratum C shows levels below action levels, it will prove that constituent concentrations outside of Stratum C are also below action levels. If levels above action levels are measured in Stratum C, then it is unknown whether concentrations outside of the OD Unit also exceed action levels, and a Stratum D will be created to test the concentrations. Four samples will be collected from Stratum D, using the same methodology as described for Stratum C in Section 4.

This stratum, however, is for determining constituent concentrations only and the boundary of the 20,000-Pound OD Unit will not be moved to include the sampling Stratum D.

10.0 REFERENCES

Draft Closure Plan, 300-lb Open Burn Area. Radian Corporation. April, 1995.

Elementary Survey Sampling. William Mendenhall et al., 1971. Pgs. 53-64.

Hahn, Gerald J. and William Q. Meeker, 1991. *Statistical Intervals, A Guide for Practitioners*.

Sampling Techniques. William G. Cochran, 1977. Pgs 89-149.

SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2. SAS Institute, 1989.

Shapiro, S.S., and M.B.Wilk, 1965. "An Analysis fo Variance Test for Normality (complete samples)," Biometrika, 52, Pgs. 591-611.

Understanding Robust and Exploratory Data Analysis, David C. Hoaglin, Frederick Mosteller, and John W. Tukey, 1983. John Wiley and Sons, Inc.

U.S. Environmental Protection Agency (EPA), June 1992. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Addendum to Interim Guidance*, Office of Solid Waste, Washington, D.C.

U.S. EPA, November 1986. *Test Methods for Evaluating Solid Waste*, SW-846, 3rd Edition, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. EPA, October 1993. *Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process*, EPA QA/G-4.

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20,000-POUND OD UNIT
RCRA PART B PERMIT APPLICATION

DRAFT FINAL

Prepared for

49 CES/CEV
550 Tabosa Avenue
Holloman Air Force Base, New Mexico 88330-8458

and

AFCEE/ERD
3207 North Road
Brooks Air Force Base, Texas 78235-5328

Prepared by

Radian Corporation
1821 Carlisle Blvd., N.E.
Albuquerque, NM 87110

December 1995 (Revision 3)
October 1992 (Revision 2)
April 1991 (Revision 1)
November 1988

Table E-3
Meteorological Data for Holloman AFB[a]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average or Extreme
Temperature (°F)													
Monthly mean	41	46	52	61	69	81	79	73	62	49	49	42	61
Mean daily high	58	60	66	76	84	93	91	86	76	63	63	55	75
Mean daily low	28	31	37	43	54	68	66	60	48	35	35	26	47
record high	78	80	90	94	109	108	106	102	92	82	82	75	109
Record low	-11	0	9	23	26	52	54	38	26	3	3	2	-14
Precipitation (in)													
Monthly mean	0.5	0.4	0.3	0.2	0.4	0.7	1.2	1.3	1.2	0.9	0.3	0.5	7.9
Record maximum	1.9	1.4	3.0	0.8	2.9	3.6	3.7	4.4	3.5	4.2	2.5	2.4	4.4
Record minimum	0	T[b]	0	0	0	T	T	0.2	T	0	0	0	0
Relative humidity (%)													
4 a.m. mean	66	61	52	40	42	62	60	66	68	61	61	63	57
1 p.m. mean	42	35	27	19	24	19	31	35	38	34	34	37	31
Surface wind													
Mean velocity (knots)	4	4	6	7	4	6	5	5	4	4	4	4	5
Prevailing direction	N	N	S	S	S	S	S	S	S	S	S	S	S

[a] Source: Radian, 1992.

[b] T = trace.

Table D.1-1
Meteorological Data for Holloman AFB[a]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average or Extreme
Temperature (°F)													
Monthly mean	41	46	52	61	69	81	79	73	62	49	49	42	61
Mean daily high	58	60	66	76	84	93	91	86	76	63	63	55	75
Mean daily low	28	31	37	43	54	68	66	60	48	35	35	26	47
record high	78	80	90	94	109	108	106	102	92	82	82	75	109
Record low	-11	0	9	23	26	52	54	38	26	3	3	2	-14
Precipitation (in)													
Monthly mean	0.5	0.4	0.3	0.2	0.4	0.7	1.2	1.3	1.2	0.9	0.3	0.5	7.9
Record maximum	1.9	1.4	3.0	0.8	2.9	3.6	3.7	4.4	3.5	4.2	2.5	2.4	4.4
Record minimum	0	T[b]	0	0	0	T	T	0.2	T	0	0	0	0
Relative humidity (%)													
4 a.m. mean	66	61	52	40	42	62	60	66	68	61	61	63	57
1 p.m. mean	42	35	27	19	24	19	31	35	38	34	34	37	31
Surface wind													
Mean velocity (knots)	4	4	6	7	4	6	5	5	4	4	4	4	5
Prevailing direction	N	N	S	S	S	S	S	S	S	S	S	S	S

[a] Source: Radian, 1992.

[b] T = trace.

Table C-4

Characteristics of Constituents in Propellants or Explosives Thermally Treated at the OD Unit (a,b)

	Explosion Temperature (°C)	Heat of Detonation (Kcal/mol)	Heat of Combustion (Kcal/mol)	Gas Volume on Detonating	Impact Sensitivity (cm)	Spark Sensitivity	Storage Stability	Solubility (mg/L)
Nitrocellulose	230	272	661	700	9	High	Hydrolysis	Insoluble Hygroscopic (3%)
Nitroglycerin	222	337	368	715	16	Moderate	Stable	1600
RDX	260	285	507	908	32	Moderate	Stable	50
PETN	215	439	600	790	17	Sensitive	Stable	Unknown
Lead Azide	340	106	183	308	10	Sensitive	Stable	500
Lead Styphnate	282	213	585	368	17	Sensitive	Stable	1000
Tetryl	257	324	839	760	26	Sensitive	Stable	75
Mercury Fulminate	210	122	267	243	5	Sensitive	Stable	700
DDNP	195	172	681	865	10	Sensitive	Stable	Insoluble
Barium Nitrate	NA	NA	NA	NA	NA	NA	Stable	8.7×10^4
Potassium Nitrate	NA	NA	NA	NA	NA	NA	Stable	1.3×10^5
Potassium Chlorate	NA	NA	NA	NA	NA	NA	Stable	7.1×10^4
Antimony Sulfide	NA	NA	NA	NA	NA	NA	Stable	1.7
Lead Thiocyanate	NA	NA	NA	NA	NA	NA	Stable	500

Table C-3
Composition of Specific Propellants Thermally Treated at the OD Unit
(also included is the RDX detonator)

Component	Constituent*	Mass or Concentration Weight %	Hazardous Waste Number
Rocket motor (5.0")*	Nitrocellulose Nitroglycerin Diphenylamine Potassium Sulfate	11.8 kg 8.2 kg 0.6 kg 0.3 kg	D003 D003, P081
Rocket motor (2.75")*	Nitrocellulose Nitroglycerin Diphenylamine Potassium Sulfate	2.0 kg 1.5 kg 0.3 50 grams	D003 D003, P081
Propellant detonator (not always present	Barium or Potassium Nitrate Lead Styphnate or DDNP Carbon Calcium Silicide	0.45 - 0.60 grams 0.20 - 0.40 grams 0.01 - 0.10 grams 0.10 grams	D001, D005 D003, D008
C-4 Detonating Charge (a,b) (size varies)	RDX Wax (polyisobutylenetethlhexyl-sebacate)		
Initial detonator cap (a) (for C-4 charge used in detonation)	Lead Styphnate Lead Azide Trinitrophenylmethylnitramine Mercury Fulminate Diazodinitrophenol (DDNP) Tetracene	0.55 - 2.5 grams 0.05 - 0.26 grams 0.1 - 0.2 grams 0.18 - 0.24 grams 0.12 - 0.28 grams 0.18 - 0.24 grams	D003, D008 D003, D008 D003 D003, D009 D003 D003, App. VIII
Explosive priming cap (b) (for C-4 charge used in detonation)	Potassium Chloride Antimony Sulfide or Lead Thiocyanate Lead Azide, PETN, or DDNP	0.05 - 0.05 grams	

(a) - Primer components (oxidant/fuel) are indicated in C-5.
(b) - Inerts include diphenylamine, potassium sulfate and wax, and were not considered.
* - May contain up to 2.5% Dinitrotoluene (U105, U106), but does not meet listing criteria and is present only as an appendix VIII hazardous constituent.
NOTE: The C-4 charge and its primary charges used for detonation are not wastes but are serviceable ordinance used to initiate the reaction.

Table C-2

Explosive Compounds Used or Treated at the OD Unit

Name	Chemical Formula	Use
AMATOL	(ammonia nitrate/TNT)	main charge, armor piercing projectiles
AMMONAL	(ammo nitrate/TNT/Al)	main charge, semi-armor piercing bombs
AMMONIUM NITRATE	NH_4NO_3	main charge, cratering chg
BALLISTITE	(nitrocellulose/nitroglycerin/ diphenylamine/graphite)	propellant, rocket motors
BARATOL	(TNT/BARIUM NITRATE)	main charge
BLACK POWDER	(potassium nitrate/charcoal/sulfur)	propellant, mixtures
COMP A	(RDX/wax)	boosters, fuzes
COMP B	(RDX/TNT/wax)	main chg, projectiles, bombs, warheads
COMP C-4	(RDX/oil/polyisobutylene/ diethylhexylsebacate)	demotion charge
CYCLOTRIMETHYLENE TRINITRAMINE (RDX)	$C_3H_6N_6O_6$	mixture, detonators, demo charges
DBX	(ammo nitrate/RDX/Al)	main charge, depth bombs
DIAZODINITROPHENOL (DDNP) (DINOL)	$HOC_6H_3(NO_2)_2N$	blasting caps, detonators
DOUBLE BASE SMOKELESS POWDER	(guncotton/nitroglycerin)	propellant
EXPLOSIVE D (AMMONIUM PICRATE)	$NH_4C_6H_2N_3O_7$	bursting chg, armor piercing projectiles
GUNCOTTON	(nitrocellulose)	propellant
HEXANITE #26	(TNT/HND/Al)	main charges

Name	Chemical Formula	Use
HEXITE (HEXANITRO-DIPHENYLAMINE)	$C_{12}H_5N_7O_{12}$	mixtures
HMX	$C_4 H_8N_8O_8$	mixtures, boosters
H-6	(RDX/TNT/Al/CaCl)	main charges, naval bombs, depth charges
HTPB (HYDROXY-TERMINATED POLYBUTADIENE)	HO-(C H) -OH	solid fuel propellant
LDNR	$PbC_6H_2N_2O_6$	blasting caps
LEAD STYPHNATE	$C_6H(NO_2)_3(O_2Pb)$	initiators, primers, detonators
MANNITOL HEXANITRATE	$C_6H_8(NO_3)_6$	initiators, blasting caps
MERCURY FULMINATE	$HgC_2N_2O_2$	initiators, blasting caps
MINOL	(TNT/ammo nitrate/Al)	main charges, bombs, projos
NITROGLYCERIN	$C_3H_5(ONO_2)_3$	propellant compositions
PENTOLITE	(TNT/PETN)	bursting chgs
PETN	$C(CH_2ONO_2)_4$	mixtures, boosters, detonating cord
PICRATOL	(Explosive D/TNT)	main charges
PICRIC ACID #26	$C_6H_2(NO_2)_3OH$	boosters, bombs
PICRITE	$CH_4N_4O_2$	propellant
TETRYL	$(NO_2)_3C_6H_2N(NO_2)CH_3$	mixtures, boosters
TNPH	$C_6H_2(NO_2)_3C_2H_5$	mixtures, boosters, (sub for TNT)
TORPEX	(RDX/TNT/Al)	main charges, mines, torpedoes

Table C-2
(Continued)

TNT	$C_6H_2CH_3(NO_2)_3$	main charges, demo chgs, boosters, mixtures
TRITONAL	(TNT/Al)	main charges, bombs
TYPE 88 #26	(ammonium perchlorate/ferro-silicon/wood meal/crude petroleum)	main charges
TYPE 91 #26	$C_6H_2OCH_3(NO)_3$	main charges
TYPE 92 #26	(TNT/Al)	burster for Japanese bullets
TYPE 98	(trinitroanisol/hexanitro-diphenylamine)	primer, burster charge
TNA	$C_6H_3N_5O_8$	boosters
OCTOL	(HMX/TNT)	main charge, shape charges
METHYL PICRATE	$C_6H_2OCN_3(NO_2)_3$	main charge, bombs
POTASSIUM PERCHLORATE	$KClO_4$	pyrotechnic, fireworks
PHOTO FLASH POWDER	(barium nitrate/potassium perchlorate/Al)	ground burst simulators, photo bombs and projos
THERMITE	Fe_2O_32Al	grenades, document destroyers
THERMATE	Fe_2O_3 Al + Ba nitrate	document destroyers
HC SMOKE	ZnO_2C_6Cl Al	screening smoke
TITANIUM TETRACHLORIDE	$TiCl_4$	spotting chgs
WHITE PHOSPHORUS	P_4	screening/marking smoke
PLASTICIZED WHITE PHOSPHORUS	P_4 + synthetic rubber	marking smoke

Table C-1
Standard Compositions (%) for Single- or Double-Base Propellants

	M-1 (a) Single Base	M-3 Single Base	M-14 Single Base	Double-Base Common	Double Base Calibers 20, 30, 50	Double Base Mortar Propellant	Double Base Rocket Propellant M-Series	Double Base Rocket Propellant T-Series (a)
Nitrocellulose	84.2	79	89.1	77 - 81	74 - 84	52 - 57	55 - 58	58
Nitroglycerin				15 - 19	15 - 20	40 - 43	30 - 40	22 - 40
Barium/Potassium Nitrate				2.1	0.0 - 1.5	1.25 - 1.5		
Potassium Perchlorate							0.0 - 7.8	
Graphite				0.3	0.0 - 0.25			
Dinitrotoluene	9.9	15	7.9					0.0 - 2.5
Trinitrotoluene								
Diphenylamine					0.75	0.75	1.0 - 8.0	1.75 - 8.0
Diethylphenylamine				0.6		0.0 - 0.6		
Potassium Sulfate							0.0 - 1.5	0.0 - 1.5
Tracetin		5	2.0					
Dibutylphthalate	4.9		1.0			3.0		
Cryolite	1.0	1.0						

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SECTION J
CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS

During the period from August 1-12, 1988, representatives of EPA, Region VI were present at Holloman AFB to conduct a RCRA facilities assessment. The results of this assessment are included in "RCRA Facility Assessment, Preliminary Review/Visual Site Inspection Report, Holloman AFB, Nm EPA, I>D> #6572124422:, prepared for U>S> EPA Region VI by A. T. Kirney, Inc. and DPRA, September 1988.

SECTION K
OTHER FEDERAL LAWS

Information will be provided in accordance with the requirements of 40 CFR part 270.14(b) (20) at the request o f the New Mexico Department of Health and Environment. At this time, however, this facility is belied to be in compliance with the following federal laws: Wild and Scenic Rivers Act, National Historic Preservation Act of 1966, Endangered Species Act, Coastal Zoane Management Act, and the Fist and Wildlife Coordination Act.

SECTION L
CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: _____

Title Deputy Base Civil Engineer

Date: October 26, 1992

SECTION I

CLOSURE PLAN, CONTINGENT POST-CLOSURE PLAN, AND FINANCIAL REQUIREMENTS

This section contains the closure plan, contingent post-closure plan, and financial assurance information for the 20,000 Pound OD Unit at Holloman AFB (EPA ID NM6572124422) and is submitted in accordance with the requirements of 40 CFR 264.110 through 264.115, 270.14(b)(13), and 270.14(b)(15) through (18). Holloman AFB will also remain in compliance with all closure conditions as stated in the NMHWMR-7, Parts V and IX, regulations. Where federal and state requirements differ, the more stringent requirement will be met.

The closure plan and post-closure plan record copies will be maintained on-Base by the Environmental Flight Chief at Holloman AFB, New Mexico, until closure and post-closure care is completed and certified by the permittee and signed by a licensed professional engineer. An additional copy of these plans will be available at the Alamogordo Public Library. These plans will be updated as necessary by issuing either page changes or new copies, as appropriate, to all plan addressees. All contact concerning these plans should be addressed to:

Environmental Flight Chief
49 CES/CEV
Holloman AFB, NM 88330
phone: (505) 475-3931

I-1CLOSURE PLAN [NMHWMR-7, Parts V and IX; 40 CFR 264.112 and 270.14(b)(13)]

Holloman AFB, located near Alamogordo, New Mexico, is a RCRA permitted treatment, storage, and disposal (TSD) facility. As part of normal industrial operations, the Base is involved in the management of solid and hazardous wastes. One element of these operations is the destruction of off-specification or out-dated munitions. This closure plan identifies the closure process to be employed at the site where

these activities occur—Holloman AFB's 20,000-Pound OD Unit—at any point during the site's intended operating life or for closure at the end of the operating life.

I-1a Closure Performance Standard [40 CFR 264.111]

This closure plan is designed to ensure that the 20,000-Pound OD Unit will not require further maintenance and controls, will minimize and eliminate threats to human health and the environment, will prevent the escape of hazardous wastes, hazardous constituents, or waste decomposition products to soils, surface waters, groundwater or the atmosphere, and will comply with all relevant closure requirements. To achieve this standard, measures taken during the active life as well as those that will be conducted during closure have been formulated specifically to address these criteria, as specified in 40 CFR 264.111.

I-1a(1) Summary of Activities Conducted During Active Life

During the active life of the unit, the post-treatment residuals and soils are sampled annually to demonstrate treatment effectiveness and ensure that residuals are nonhazardous. During the interim period between treatment events, the unit is periodically graded and residuals in the unit remain covered to retard leachate formation and prevent wind dispersal. Annually, residuals and soils are sampled for characteristics of hazardous waste and suspected hazardous constituents, as specified in the Sampling and Analysis Plan (SAP) provided as Attachment C-1. The SAP documents all of the protocols used during active-life sampling events.

I-1a(2) Summary of Closure Activities

At the conclusion of the final treatment event, the site will be inspected and all debris will be removed. Following these activities,

representative samples from across the entire 20,000-Pound OD Unit will be collected and analyzed (as described in Section I-1d and the SAP) to determine the residual concentrations of any toxic metals and explosive compounds (if any). These analytical results will be compared to background levels or, as described in Attachment C-1, risk-based criteria deemed to be protective of human health. If all levels are determined to be below background (for metals) or the analytical detection limits (for organics), the closure will be considered clean closure. If levels are detected in excess of background or detection limits but are below risk-based criteria, the closure will be considered a risk-based closure.

In the event that an area of the unit is determined to contain levels in excess of risk-based criteria, further action will be taken as necessary in coordination with NMED prior to completing closure, such as risk assessment, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. When all such activities have been completed (as required) and all samples show that the residual levels of contamination are below the risk-based criteria, all remaining closure and post-closure activities will be completed, including grading, decontamination, and closure certification. More detailed descriptions of the specific activities that will be conducted to ensure that the closure performance standard is met are presented in the following sections.

I-1bPartial and Final Closure Activities [40 CFR 264.112(a)(1) and (b)(4)]

The closure of the 20,000-Pound OD Unit is considered a partial closure, since the anticipated closure of this site will occur prior to closure of the rest of the Base.

I-1c Maximum Waste Inventory [40 CFR 264.112(b)(3)]

Operating practice precludes the storage of hazardous wastes at the 20,000-Pound OD Unit. For safety reasons, waste munitions are treated as received or as generated and no other wastes are stored at the site. During operation, the maximum amount of hazardous wastes treated during a single OD event at any time during the life of the facility is 20,000 pounds NEW of waste munitions. No waste munitions will be present at the site upon initiation of closure activities.

I-1d Inventory, Removal, Disposal, and Decontamination of Equipment [40 CFR 264.112(b)(4)]

As outlined in I-1a, the steps to achieve the closure standard include site reconnaissance, removal of scrap materials and debris, closure sampling and analysis, risk-based screening, corrective action (if needed), surface grading, decontamination, and closure certification. Appropriate personal protective equipment (PPE) will be worn during each of these steps. Each step is discussed in detail below.

I-1d(1)Site Reconnaissance

Following the final treatment event, the unit will be inspected to ensure that the planned closure approach can be implemented. The inspection will consist of a visual site inspection (VSI) to identify the location of any scrap materials, debris, or any other substances that may impede closure of the unit. All materials that need to be removed prior to proceeding with closure will be documented in a field inspection logbook.

I-1d(2)Removal of Scrap Materials and Debris

On the basis of the VSI, any identified scrap, debris, or other

substance that could impede closure of the unit will be removed and disposed of in accordance with applicable requirements. Because treatment renders waste munitions nonhazardous, and because hazardous wastes are not stored at the site, it is anticipated that scrap materials and debris will be non-hazardous and can be managed as specified in the provisions of RCRA Subtitle D (40 CFR 257).

I-1d(3) Closure Sampling and Analysis

Following the activities specified in I-1d(1) and (2), representative samples from the 20,000-Pound OD Unit will be collected and analyzed to determine the residual concentrations of any toxic metals and high explosive (HE) compounds. Because abundant data will have been gathered during prior annual sampling events, and because it is important to verify that the entire area of the OD Unit has been adequately sampled, a non-stratified sampling approach will be used. For example, a geostatistical approach may be used for determining the placement and numbers of samples for closure. This approach will account for the spacing of previous samples and identify areas where additional sampling will be required. Once sampling location have been determined, hand auger samples will be collected from the surface interval (0-1 ft) at each of these locations and sent to an approved laboratory for analysis. Analyses to be performed include:

- SW7041 (antimony);
- SW7060 (arsenic);
- SW7421 (lead);
- SW7471 (mercury);
- SW7740 (selenium);
- SW6010 (metals); and
- SW8330 (explosives).

Because no materials other than waste munitions are stored or treated at the site, no other analyses are required. A complete description of the sampling and analysis protocol and rationale, including that to be followed during closure, is provided in the SAP.

I-1d(4) Background Comparison and Risk-Based Screening

Following sampling and analysis, the analytical results will be compared to background results, as described in Section 8.2 of Attachment C-1, and appropriate risk-based standards deemed to be protective of human health. In the event that a sample or area of the site is determined to contain levels in excess of these standards, NMED will be contacted to discuss further action prior to completing closure, such as risk assessment, confirmation sampling, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. When all such activities have been completed (as required) and all sample results show that the residual levels of contamination are below the risk-based criteria or are protective of human health and the environment, all remaining closure activities will be completed.

I-1d(5) Corrective Action

As mentioned in I-1d(4), if any sample or area is determined to contain contaminant concentrations in excess of the risk-based criteria, remaining closure activities will be postponed until the Base and NMED jointly decide on the appropriate corrective action. Possible corrective actions could include risk assessment, confirmation sampling, delineation of the extent of the exceedence, analysis of corrective measures, and corrective measures implementation. Any hazardous investigation-derived waste and/or remediation waste that is generated and exceeds the risk-based criteria will be stored at the Holloman AFB Defense Reutilization and Maintenance Organization (DRMO) facility prior to shipment to an authorized disposal facility using an authorized transporter.

I-1d(6) Surface Grading

Once all scrap materials and any other debris have been removed,

and sampling results indicate that all remaining analytes are below health-based criteria, the unit will be graded to manage surface water infiltration and run-off while controlling erosion. Specifically, surface grading will reduce ponding and runoff velocities that can contribute to soil erosion, and will roughen and loosen soils to facilitate natural revegetation.

I-1d(7) Decontamination

Following all activities in I-1d(1) through I-1d(6), all equipment will be washed with detergent and triple rinsed with water. All PPE and rinsewater will be disposed of properly.

I-1d(8) Certification of Closure

Following the performance of all closure activities, a certification of closure will be submitted by registered mail to the NMED RCRA Program Manager and/or the EPA Regional Administrator no later than 60 days following completion of all closure activities. The specifications for this certification are detailed in Section I-1g of this closure plan.

I-1e Other Activities [40 CFR 264.112(b)(5)]

In addition to the closure activities specified in I-1d, other tasks will be performed to ensure that the closure activities satisfy the closure performance standard. These tasks include periodic regrading and maintenance to retard erosion and run-on/runoff, and continued posting and security measures. A complete discussion on these activities is included as part of the Post-Closure Plan for the 20,000-Pound Unit, Sections I-2b and I-2c. Groundwater monitoring will not be conducted and a waiver from this activity is being requested as part of this permit application (see Attachment D-1). A waiver from the groundwater monitoring requirements is being requested because: 1) the unit does not receive or contain wastes containing free liquids; 2)

there is no potential for migration of contaminants to the groundwater; 3) the total dissolved solids (TDS) levels in the local groundwater has led to NMED classification of the aquifer as unpotable; 4) the remote location of the unit results in no potential receptors for the groundwater; and 5) there is no risk associated with the use of groundwater since the resource is not used.

I-1f Schedule for Closure [40 CFR 261.113(b)]

As specified in 40 CFR 261.113(b), closure activities at the 20,000-Pound OD Unit will be completed within 180 days of treating the final volume of hazardous waste. No extension beyond the 180 days provided is being requested at this time; however, if it is determined that an extension is needed, this plan will be modified. Notification of intent to close will be submitted to the NMED RCRA Program Manager and the USEPA Regional Administrator. The anticipated date for the initiation of closure activities is 1 January 2050. Table I-1 presents an estimated closure schedule.

Table I-1

Estimated Closure Schedule for the 20,000-Pound OD Unit

Closure Activity	Closure Period (Days)
Receive and treat final volume of waste	-10 to 0
Closure begins	0
Perform site reconnaissance	0 to 5
Remove scrap	5-15
Soil Sampling and Analysis	15-50
Address any exceedences of standard (if any)	50-130
Grade	130-140
Decontaminate equipment	140-150
Prepare closure certification/post-closure documentation	150-180
Submit closure certification/post-closure documentation	180
NMED issues post-closure permit	180-235
Conduct post-closure care activities	235-2060

I-1gCertification of Closure [40 CFR 264.115]

Upon completion of all activities specified in I-1d, certification that the closure of the 20,000-Pound OD Unit was performed in accordance with the specifications in the approved closure plan will be submitted by registered mail to the NMED RCRA Program Manager and/or the EPA Regional Administrator no later than 60 days following completion of all closure activities. The certification will be signed by an authorized official of Holloman AFB and an independent registered professional engineer. Documentation supporting the independent professional engineer's certification will be furnished to the NMED RCRA Program Manager and/or the EPA Regional Administrator upon request.

I-2CONTINGENT POST-CLOSURE PLAN [NMHWMR-7, Parts V and IX; 40 CFR 264.117, 264.118, and 264.602]

Because some residues may remain in place, this contingent post-closure plan provides a description of the activities that may be conducted to ensure long-term reliability and effectiveness of the closure. This section is based on the general requirements of 40 CFR 264.117, 264.118, 264.602, and 264.603.

I-2aPost-Closure Care and Use of Property [40 CFR 264.117]

The following subsections describe the post-closure care period, site security during the post-closure period, and the post-closure use of the site.

I-2a(1)Post-Closure Care Period [40 CFR 264.117(a)(1)]

If any waste residues are left in place, contingent post-closure care activities—as specified in I-2a(2)—will be required to ensure the long-term integrity of the closure and continued protection of human health and the environment. However, several factors suggest that the duration of any post-closure activities should be limited, including:

- The treatment activities render the waste munitions non-hazardous;
- The risk-based closure activities will ensure that no residues remain in concentrations exceeding established health-based criteria;

- The nature of the treatment, the waste residues, and the closure approach substantially minimize the likelihood of any contaminant migration; and

- Groundwater beneath Holloman AFB has been designated by NMED as unfit for human consumption due to levels of total dissolved solids that exceed human health standards.

Therefore, the post-closure period for carrying out any post-closure activities in I-2a(2) is limited to five (5) years from the date of closure certification.

I-2a(2)Post-Closure Security [40 CFR 264.117(b) and 264.14]

Although the closure plan will ensure that all contaminants are reduced to levels protective of human health and the environment and will minimize the potential for contaminant migration, because some residual contamination may remain in place, security that was used for the management of hazardous wastes will be provided during the contingent post-closure period to prevent access to the site. The security mechanisms that will be in-place during the contingent post-closure period will include the following:

- Utilization of the Base's existing 24-hr security system (guards making routine rounds) to provide continuous monitoring of the unit; and

- Access control to the Base via fence, gate and other entry control devices.

In addition to these measures, the 20,000-Pound OD Unit will be clearly posted with signs that state, “DANGER—UNAUTHORIZED PERSONNEL KEEP OUT.” These signs will be posted at all entrances and at other locations so as to be seen from any approach to the unit. The legend will be written in both English and Spanish and will be legible from a distance of 25 feet.

I-2a(3)Post-Closure Use of Property [40 CFR 264.117(c)]

The post-closure uses of the property following partial or final closure of the facility may not result in the disturbance of the final grading or vegetative cover. Post-closure use resulting in such a disturbance will only be allowed if necessary [40 CFR 264.117(c)(1)] or required to protect human health and the environment [40 CFR

264.117(c)(2)].

I-2bPost-Closure Care Monitoring [40 CFR 264.118(b)(1) and 264.602]

As discussed in Attachment D-1 of the permit application, an exemption from the requirement to monitor groundwater is being requested for the 20,000-Pound OD Unit. In general, the request for exemption is based on a number of factors, including: 1) the unit does not receive or contain wastes containing free liquids; 2) there is no potential for migration of contaminants to the groundwater; 3) the total dissolved solids (TDS) levels in the local groundwater has led to NMED classification of the aquifer as unpotable; 4) the remote location of the unit results in no potential receptors for the groundwater; and 5) there is no risk associated with the use of groundwater since the resource is not used. Because an exemption is being requested, this post-closure plan does not address any procedures, frequencies for monitoring of the site during the post-closure care period. In the event that the exemption is denied, this plan will be modified to include the appropriate monitoring procedures and frequencies for the OD Unit.

I-2c Post-Closure Maintenance Requirements [40 CFR 264.118(b)(2)]

This section of the post-closure plan summarizes the maintenance activities that will occur at the site as detailed in Section D of the permit application. The majority of maintenance activities will be contingent upon the results of routine (quarterly) inspections. Maintenance activities include maintaining all site markings and other benchmarks, access control devices, and postings. Table I-2 outlines these activities and frequency of occurrence.

I-2d Certification of Post-Closure Care [40 CFR 264.120]

As with the closure plan, certification that all contingent post-closure activities for the 20,000-Pound OD Unit were performed in accordance with the specifications in the approved post-closure plan will be submitted by registered mail to the NMED RCRA Program Manager and/or the EPA Regional Administrator no later than 60 days following completion of all post-closure activities. The certification will be signed by an authorized official of Holloman AFB and an independent registered professional engineer

licensed to practice in New Mexico. Documentation supporting the independent professional engineer's certification will be furnished to the NMED RCRA Program Manager and/or the EPA Regional Administrator upon request.

I-3FINANCIAL REQUIREMENTS FOR CLOSURE AND POST-CLOSURE [40 CFR 264.142 through 264.145]

Holloman AFB, including the 20,000 pound OD Unit, is owned and operated

Table I-2

Required Maintenance Activities and Schedule

Area/ Equipment	Specific Items	Types of Problems	Corrective Action	Frequency of Inspection
Security Devices	Fence	Broken/ Damaged	Repair immediately if damaged	Quarterly
	Access Gate	Locking mechanism jammed	Repair/replace	Quarterly
	Signs	Illegible	Replace	Quarterly
Final Cover/ Grading	Cover/ Grading Integrity	Subsidence, excessive bare soil, rodent burrows	Restore site to grade	Quarterly (immediately following any 10 year, 24-hour intensity rainfall event)
Run-on/Runoff Drainage Control	Drainage sloping and channels	Settlement, ponded water, blockage, erosion	Repair settlement and erosion, remove blockages	Quarterly
Benchmarks	Not Applicable	Damaged	Replace if Damaged	Quarterly

by the federal government and, as such, is exempt from the financial requirements for hazardous waste management facilities specified under 40 CFR Subpart H. This exemption applies to 40 CFR Parts 264.142 (Cost Estimate for Closure), 264.143 (Financial Assurance for Closure), 264.144 (Cost Estimate for Post-Closure Care), and 264.145 (Financial Assurance for Post-Closure Care).

I-4 SURVEY PLAT AND POST-CLOSURE NOTICES [40 CFR 264.116 and 264.119]

As specified in 40 CFR 264.116 and 264.119, a survey plat and deed notification will be necessary to satisfy the closure and any contingent post-closure care requirements. Therefore, upon completion of all closure activities, a survey plat will be submitted with the certification of closure to the local zoning authority, the NMED RCRA Program Manager, and the EPA Regional Administrator, delineating the boundary of the closed 20,000 Pound OD Unit. Following closure and any post-closure care activities, Holloman AFB's deed will be amended to record the closed unit. This deed recordation will, in perpetuity, notify any potential purchaser of the property that the land has been used in the management of hazardous waste and its use is restricted as specified in Section I-2a(3) of the post-closure care plan and 40 CFR 264.117(c).

I-5 LIABILITY REQUIREMENTS

Holloman AFB, including the 20,000-Pound OD Unit, is owned and operated by the federal government and, as such, is exempt from the liability insurance requirements for hazardous waste management facilities specified under 40 CFR Subpart H.

~~SECTION I~~

~~CLOSURE PLANS, POSTCLOSURE PLANS, AND FINANCIAL REQUIREMENTS~~

~~I-1 CLOSURE PLANS~~

~~The 20,000lb Ed Area site is located in the northwest portion of the Holloman AFB boundary. Figures B-3 and B-4 fulfill the topographic map requirements and indicate the position of the unit within the base property.~~

~~The 20,000lb ED Area site is used to provide treatment to waste propellant compositions. Posttreatment inspections ensure that all energetic materials are treated. Additionally, sampling protocols, described in Section C, are designed to confirm that all energetic wastes are destroyed and that hazardous residuals do not remain in the area. Both residuals do not remain in the area. Both the residuals and underlying soils are sampled to confirm treatment effectiveness and to ensure that no hazardous wastes are disposed of. As a result of these factors, this closure plan presupposes "clean closure." If sampling results indicate that clean closure cannot be achieved, a modification to the closure plan will be submitted 60 days prior to the date scheduled for initial closure actions.~~

~~I-1a CLOSURE PERFORMANCE STANDARD~~

~~This closure plan is designed to ensure that the unit will not require further maintenance, minimize the threat to human health and environment, and control or eliminate the escape of hazardous waste, hazardous constitutes, leachate, contaminated runoff, or decomposition products. This standard is met in the following manner:~~

~~**1.** During the active life of the unit, the posttreatment residuals and soils are sampled to demonstrate treatment effectiveness and ensure that residuals are nonhazardous.~~

~~**2.** During the interim period between treatment events, the residuals in the unit remain covered in order to retard leachate formation and prevent wind dispersal.~~

~~**3.**Annually, residuals and soils are sampled for characteristics of hazardous waste and suspected hazardous constituents. Residuals and soils that do not meet the criteria specific in Section D are removed from the unit until the underlying soil base is "clean". Residuals and soils that are within the acceptable range are covered with natural fill.~~

~~**4.**The results of the sampling will be submitted to NMED during the unit's active life.~~

~~I-lb PARTIAL AND FINAL CLOSURE ACTIVITIES~~

~~The closure of the 20,000lb ED Area site is a partial closure that involves closure of only this unit. Closure of all Treatment, Storage, or Disposal Facilities (TSDFs) at Holloman AFB will occur conjunctively with cessation of all base activities. This partial closure will be consistent with the general closure performance standards of 40 CFR 264.601. Coverage after us that occur during the active life of the unit are not considered partial closure. The anticipated date for initiation of these closure activities is January 1, 2050.~~

~~I-1c MAXIMUM WASTE INVENTORY~~

~~No inventory of waste will be present at the 20,000lb ED Area site at the time of closure. The total mass limit per treatment event is 20,000 pounds. The percentage of energetic material in propellant devices is estimated to range from 40 to 50% of the total mass. Consequently, the probable total energetic mass seldom exceeds 10,000 pounds.~~

~~I-1d INVENTORY REMOVAL, DISPOSAL, OR DECONTAMINATION OF EQUIPMENT~~

~~After the final treatment, residuals and soil samples will be taken in the final pit of the unit to demonstrate that no hazardous wastes remain and that hazardous constituents have not migrated during the active life of the subunit. If sampling results indicate otherwise, residuals and soils will be handled in the manner specified for the active life. The method for removal, disposal, and equipment decontamination, if required, is specified below.~~

~~I-1d(1) CLOSURE OF CONTAINERS~~ ~~-- Not Applicable~~

~~I-1d(2) CLOSURE OF TANKS~~ ~~-- Not Applicable~~

~~**I-1d(3) CLOSURE OF WASTE PILES** -- Not Applicable~~
~~**I-1d(4) CLOSURE OF SURFACE IMPOUNDMENTS** -- Not Applicable~~
~~**I-1d(5) CLOSURE OF INCINERATORS** -- Not Applicable~~
~~**I-1d(6) CLOSURE OF LAND TREATMENT ZONE** -- Not Applicable~~
~~**I-1d(7) CLOSURE OF LANDFILLS** -- Not Applicable~~
~~**I-1d(8) CLOSURE OF MISCELLANEOUS UNITS**~~
~~**I-1d(8) (a) COVERAGE AFTER USE**~~

~~As previously described, the underlying soils that remain in the pit are sampled and analyzed annually according to the protocols described in Section C. If the analytical results indicate that the residuals are hazardous, the residuals are removed from the pit. Prior to coverage underlying soils are sampled and analyzed at depths of approximately 1 foot intervals for the set of parameters as indicated in Section C. If these results indicate the soils are contaminated above the criteria listed in Section D, both the residuals and the soils will be excavated to a depth of approximately 1 foot. The removal, disposal, and decontamination procedures are summarized below.~~

~~**STEP 1 - INITIAL SAMPLING**~~

~~Following a treatment event and prior to coverage after use, residuals and soils are examined according to Section C. After annual sampling, if the soils are not contaminated, the unit is continued to be used. If sampling results indicated that residuals are hazardous or that underlying soils are contaminated, the remainder of the steps in this section are performed.~~

~~**STEP 2 - REMOVAL**~~

~~Residues and soil will be excavated to a depth of approximately 1 foot and containerized for disposal as hazardous waste in a permitted TSDF. Prior to disposal, these wastes will be stored in the Defense Reutilization and Marketing Office (DRMO) container storage facility. After removal of the first 1 foot of soil, random coring of soils under the trench will be taken with a hand-held auger to a depth of approximately 1 foot and composited for analysis. Locations were determined or described in Section C. If results indicate that criteria are not met in the first 1 foot, these soils will be removed by standard excavation equipment and managed as hazardous waste. Sampling and removal~~

~~will proceed in 1-foot layers until the criteria described in Section D are met. Results from analysis of each layer will be submitted to NMED.~~

~~STEP 3 - BACKFILLING~~

~~Once the criteria in Section D are met, the excavation will be backfilled with clean soil. The top layer will consist of mixed soil (gypsum layers and topsoils, mounded to a height of approximately 12 inches, and compacted by a minimum of 5 blade passes. The closed subunit will be identified with 1-foot metal markers along all four sides.~~

~~STEP 4 - DECONTAMINATION~~

~~Upon completion of removal, all equipment used during the closure will be emplaced upon a linner that is brought to the area. This temporary base will be diked prior to equipment decontamination. All equipment will be decontaminated by steam cleaning. All rinsewaters will be collected, sampled for parameters of Section C, and if these criteria are exceeded, the rinsewaters will be handled as hazardous waste by storage at the DRMO facility and disposal at a permitted TSDF.~~

~~This form of closure is somewhat analogous to closure of a single cell in a landfill and a schedule for closure in this manner is not required. As indicated, all analytical results will be submitted to NMED and backfilling will not proceed until approval is granted.~~

~~I-1d(8) (b) - UNIT CLOSURE~~

~~The manner of operation for this unit indicates a strong probability that clean closure will be attainable. The steps taken to assure clean closure are described below.~~

~~STEP 1 - INITIAL SAMPLING~~

~~Ninety (90) days prior to the final treatment activities, soil coring samples will be taken by an auger-boring apparatus to a depth of >15 feet. Coring samples will be taken at 10-foot intervals. Sampling locations will be selected by division of the pit area into approximately 1000 grids of equal size and randomly determined in a manner similar to that described in Section C.~~

~~**STEP 2 - MODIFICATION OF PLAN 1 CLOSURE NOTICE**~~

~~In the unexpected event that sampling results indicate contaminant migration, a modified closure plan will be submitted to NMED. This plan will be based upon the extent and nature of contamination in the underlying media. The modified closure plan will be submitted to NMED 60 days prior to initiation of closure activities. If initial sampling results indicate "clean" closure is attainable, these results and a closure notice will be submitted 60 days prior to closure.~~

~~**STEP 3 - FINAL TREATMENT/CLOSURE OF FINAL SUBUNIT**~~

~~The final treatment event will performed as previously described. The posttreatment and subunit closure results will be submitted.~~

~~**STEP 4 - CLOSURE**~~

~~Clean closure will be achieved by grading of topsoils to retard erosion and runoff. To the extent practical, vegetative cover will be established. The area will be posted to indicate its previous use in a manner analogous to the current posting. Security procedures will be maintained.~~

~~**STEP 5 - CERTIFICATION OF CLOSURE**~~

~~Closure will be certified by an independent professional engineer who has had access to the closure plan, final subunit closure results, analysis of the soil cores, and the subunit during the closure activity. Certification of closure will be submitted to the NMED by registered mail within 60 days of completion of the closure action.~~

~~**I-1e CLOSURE OF DISPOSAL UNITS** -- Applicable~~

~~**I-1f SCHEDULE FOR CLOSURE**~~

~~A schedule for the closure of the unit is provided as Table I-1. Closure will be~~

~~achieve within 180 days of the final waste treatment. The anticipated date for closure is January 1, 2050.~~

~~I-1g EXTENSION FOR CLOSURE TIME~~

~~No extension for closure time anticipated; however, if an extension is necessary to properly close the 20,000 ED Area, then a petition will be sent amending the Table I-1 closure schedule. This petition will demonstrate:~~

~~**1.**the need for more that 180 days to close the site,~~
~~**2.**the reasonable likelihood that a person other than the owner/operator will recommence operation of the site, and~~
~~**3.**that closure would be incompatible with continued operation of Holloman AFB.~~

~~I-2 POSTCLOSURE~~ ~~-- Not Applicable~~

~~I-3 NOTICE IN DEED~~ ~~-- Not Applicable~~

~~I-4 CLOSURE COST ESTIMATE~~

~~This facility is federally owned and exempt from this requirement~~

~~I-5 FINANCIAL ASSURANCE MECHANISM~~ ~~-- Not Applicable~~

~~I-6 POSTCLOSURE COST ESTIMATE~~

~~This facility is federally owned and exempt from this requirement.~~

~~I-7 FINANCIAL ASSURANCE MECHANISM FOR POSTCLOSURE~~ ~~-- Not Applicable.~~

~~I-8 LIABILITY REQUIREMENTS~~ ~~-- Not Applicable~~
~~I-9 STATE MECHANISM~~ ~~-- Not Applicable~~

SECTION H

PERSONNEL TRAINING

H-1 OUTLINE OF TRAINING PROGRAM

Facility personnel who handle hazardous wastes must successfully complete a program of classroom instruction and on-the-job-training in order to prepare them to operate and maintain the facility/unit in a manner which ensures that facility's compliance with RCRA training requirements.

All DoD EOD personnel attend the Explosive Ordnance School at Indian Head Naval Ordnance Station, Indian Head, MD. Explosive Ordnance School incorporates hazardous waste management training for the specific wastes that are treated in the unit. This is the single training point for all military personnel in the EOD career field. Senior EOD personnel also support this training with on-the job training and close supervision.

H-1a JOB TITLES AND DUTIES

EOD supervisor personnel at Holloman AFB are directly responsible for the proper handling of explosive ordnance. The duties, responsibilities, and qualifications of these position are as follows:

Air Force EOD Supervisor

Responsibilities: Directs the operations at the EOD section at Holloman AFB. The EOD supervisor provides assistance and guidance on explosive ordnance disposal and management at the EOD areas.

Duties:

1. Plans, coordinates, and directs all EOD operations at Holloman AFB. Interprets regulations and develops necessary operating procedures as required. Determines requirements for manpower, space, and equipment and initiates actions required. Determines need for modifications to existing facilities and initiates action to improve economy, efficacy safety, and physical security of operations. Develops appropriate requirements and initiates requests for work.

2. Personal contacts: Maintains personal contacts with local and state government agencies and military commands.

3 Work assignment and review: Assigns work to subordinate employees or supervisors based on priorities. Makes decisions on work problems referred by subordinate supervisors. Assures that workload and project responsibilities are specifically delegated and assigned to subordinates.

H-1b TRAINING CONTENT, FREQUENCY, AND TECHNIQUES

H-1b-(1) EOD TRAINING PROGRAM

This program is taught at Indian Head, MD, and is for all EOD personnel within DoD. All personnel must pass the basic course and supervisor personnel must pass the two additional advanced courses. All EOD personnel are required to complete annual reviews of the basic course. The course outline is as follows:

1. Explosive Ordnance Disposal Specialist/Technician Career Field

A. Progression in career ladder 464X0

B. Duties of AFSCs 46430/50/70

C. History of Air Force EOD Program

2. Security

A. Communications Security (COMSEC)

(1) Classify information and use MAJCOM/SOA EEFIS

(2) Prevent security violations

(3) observe security precautions

B. Operations Security (OPSEC)

(1) Background and history of OPSEC

(2) Definition of OPSEC

(3) Relationship of OPSEC to other security programs including COMSEC, Information Security, and Physical Security

(4) Common OPSEC vulnerabilities

(5) OPSEC significance of unclassified data and procedures

(6) Specific OPSEC vulnerabilities of AFSC ~~464-X0~~3E8X1

C. ~~Resource~~ Security Requirements for EOD Publications

~~**(1)** EOD publications~~

(1) Storage requirements

(2) Control/Access procedures

(3) Destruction/Disposition requirements

(4) Transportation Requirements

(5) Security Deviation Reporting

D. Protection of firearms and munitions

~~**(3)** Arming and use of force by USAF personnel~~

3. Air Force Occupational Safety and Health

A. The USAF ~~safety~~ program

~~**B.** Principles pertaining to:~~

~~**(1)** Ground safety~~

~~**(2)** Explosives and missile safety~~

~~**(3)** Nuclear surety~~

~~**C.** Investigate and report USAF mishaps~~

B. Hazards of AFSC 3E8X1

C. AFOSH Standards for AFSC 3E8X1

D. Use of personal protective equipment

E. Fire prevention

F. Nuclear surety

G. Mishap reporting and investigation

4. Publications

A. USAF administrative publications

B. USAF technical orders (TO)

(1) USAF TO system

(2) Use indexes (NI & RI)

(3) Locate desired information

(4) Use TOs when performing tasks

(5) Establish and maintain TO files

(6) Initiate TO improvement reports

(7) Requisition TOs

C. Use TOM sub-module for posting and tracking USAF TOs

5. Participate in USAF Graduate Evaluation Program

6. EOD Flight Management

A. EOD Unit Management

(1) Organizational structure

(2) Functions and responsibilities

B. Inspection system

C. Material deficiency reporting

7. Applied Principles of Physics

A. Properties of matter

B. Laws of motion

C. Simple machines

D. Measurement systems

(1) English

(2) Metric

(3) Convert from system to system

8. Fundamentals of Electricity

A. ~~Ohms Law~~ Demolition circuitry

B. ~~Series circuit~~ Perform grounding procedures

C. ~~Parallel circuits~~ Apply electromagnetic radiation precautions

9. EOD Tools and Equipment

A. Maintain tools

B. Common Handtools

(1) Select proper tools

(2) Use tools properly

C. Special tools and equipment

(1) Select proper tools

(2) Use tools properly

D. EOD MK-Series tools

(1) Select proper tools

(2) Use tools properly

E. Use the RIC sub-module for equipment maintenance and tracking

10. Military Explosives ~~(General)~~and Propellants

A. Identification

B. ~~Characteristics~~ Effects

C ~~Effects~~ Application and use

11. Destruction of Explosive Material and Related Hazardous Materials

A. ~~Demolition equipment~~ Transportation

B. Firing systems

(1) Electric

(2) Non-Electric

C. Disposal procedures

(1) Routine

(2) Emergency

D. Munitions residue

(1) Inspect

(2) Certify

(3) ~~Turn-in~~ Disposition

E. Environmental ~~considerations~~ protection

(1) Considerations

(2) Use of EPA 8700-22 manifest

(3) EPA permits and applications

(4) Identify environmental impacts caused by EOD

(5) Identify EPA regulations and directives pertaining to EOD operations

(6) Determine EPA documentation requirements

(7) Identify responsibilities of interfacing agencies

~~**F.** Transport munitions~~

12. Render Safe Techniques

A. Immobilize fuzes

B. Remove fuzes ~~by remote means~~

C. Disable electrical components

D. Disrupt firing trains

E. Use shaped charges and demolition techniques

13. Chemical and Biological Warfare Agents

A. Classification

(1) ~~Physical state~~ Types

(2) ~~Tactical use~~ Physical state

(3) Physiological action

(4) Persistency

B. Use protective clothing and equipment

C. ~~Downwind hazards~~ Seal and package leaking munitions

D. Use detection and identification kits

E. Apply first aid/self air procedures

F. Use decontaminants and decontamination equipment

~~**14.** Chemical Munitions~~

~~**A.** Munitions characteristics~~

~~**B.** Identify~~

~~C. Seal and package leaking munitions~~

~~**D.** Respond to incidents involving chemical munitions~~

~~**E.** Transport hazardous chemical munitions~~

~~**F.** Use disposal methods~~

14. Placed Munitions

A. Land mine and fuzes

(1) ~~Classification~~ Location

(2) Identification

(3) Observe safety precautions

(4) Render safe

(5) Perform disposal procedures

B. Booby traps and fuzes

(1) Classification

(2) Identification

~~**C.** Locate~~

~~**(1)** Land mines~~

~~**(2)** Booby traps~~

~~**D.** Placed munitions and their fuze~~

~~**(1)** Render safe~~

~~**(2)** Disposal~~

~~**E.** Placed munitions of foreign countries~~

15. Projected Munitions, Rockets, and Grenades

A. Projected munitions and their fuzes

(1) ~~Classifications~~ Observe safety precautions

(2) Identification

(3) Locate

(4) Render safe

(5) Disposal

B. Projected munitions, rockets, and grenades of foreign countries

(1) Observe safety precautions

(2) Identification

(3) Locate

(4) Render safe

(5) Disposal

16. Dropped Munitions

A. Bombs and bomb fuzes

(1) ~~Classification~~ Observe safety precautions

(2) Identification

(3) Render safe

(4) Disposal

B. ~~Bomb clusters and dispensers~~ Dispensers and payload

(1) ~~Classification~~ Observe safety precautions

(2) Identification

(3) Render safe

(4) Disposal

~~**C.** Fuses~~

~~**(1)** Classification~~

~~**(2)** Identification~~

~~**(3)** Render safe~~

~~**(4)** Disposal~~

~~**D.** Dropped munitions of foreign countries~~

17. Aircraft Weapons Systems and Explosives

A. Aircraft egress/weapons systems

(1) Aircraft/egress

(2) Gun systems

(3) Release and launching systems

(4) Missile/rocket launching systems

(5) Miscellaneous explosive-actuated devices

B. Aircraft explosive devices

(1) Locate

(2) ~~Render safe~~ Identify

(3) ~~Remove~~ Observe safety precautions

(4) ~~Disposal~~ Render safe

18. Pyrotechnics

A. ~~Classification~~ Identify

B. ~~Identification~~ Observe safety precautions

C. Render safe

D. Disposal

19. Guided Missiles

A. Classification

B. Identification

C. Propulsion Systems

(1) Identification

(2) Characteristics

D. Hazardous missile components and propellants

(1) Identification

(2) Render safe

(3) Removal

(4) Disposal

E. Guided missiles of foreign countries

20. Nuclear Weapons

~~**A.** Classification~~

~~**B.** Identification~~

~~**C.** Fuzing and firing systems~~

~~**D.** Nuclear weapons and hazardous components~~

~~**(1)** Render safe~~

~~**(2)** Disposal~~

~~**E.** Use protective clothing and equipment~~

~~**F.** Use equipment~~

A. Nuclear weapons

(1) Identify

(2) Hazards

a. Explosives

b. Toxic

c. Radiological

(3) Observe safety precautions

(4) Fuzing and firing systems

(5) Render safe

(6) Package and dispose of components

B. Use protective clothing and equipment

C. Operate radiac instruments

~~**22.** Radiac Instruments, Radiological Monitoring, and Radiological Hazards~~

~~**A.** Principles of RADIAC instruments operation~~

~~**B.** Use RADIAC instruments~~

~~**C.** Perform operator maintenance on RADIAC instruments~~

D. Compute stay times

21. Explosive Ordnance Reconnaissance

A. Recognition of terrain changes due to unexploded ordnance (UXO)

B. Locate, mark, and report UXOs

C. ~~Incident categories~~ Estimate collateral damage

~~**D.** Determine hazard distances~~

~~**E.** Safety requirements~~

~~**F.** Protective works~~

D. Technical intelligence

(1) Use photographic equipment

(2) Reporting

22. Access and Recovery

A. Characteristics of soils

B. Effects of weather on soils

C. Methods of gaining access

D. Performing field rigging and improvised hoisting

E. Tie knots, bends, and hitches

23. Ranges

A. Decontaminate ranges

(1) Active

(2) Inactive

(3) Excess

B. Proficiency/~~Demolition ranges~~ training and demolition ranges

(1) Establish

(2) Maintain

24. Improvised Devices

~~**A.** Improvised explosive devices (IEDs)~~

~~**(1)** Identification~~

~~**(2)** Gain access~~

~~**(3)** Render safe~~

~~**(4)** Disposal~~

~~**B.** Radiography interpretation~~

~~**C.** Improvised nuclear devices (IND)~~

A. Locate

B. Gain access

C. Identify

D. Interpret radiographs

E. Observe safety precautions

F. Render safe

G. Perform disposal procedures

25. Base Recovery After Attack

A. Concept

B. Responsibilities

C. Pre-attack EOD procedures

D. Post-Attack EOD procedures

E. Munitions clearance vehicle CONOPS

26. Peace Time Operations

A. Develop plans for range clearance operations

B. Develop plans for ammunition disposal report operations

C. Use of demolition techniques

27. Communications/Electronics

A. Tactical radios

B. Global positioning system

C. Frequency management requirements

28. Render Safe Techniques

A. Immobilize fuses

B. Remove fuses

C. Disable electrical components

D. Disrupt firing trains

E. Use shaped charges and other explosive techniques

29. Case Attack Procedures

A. Use SMUD techniques

B. Use thermal techniques

C. Use shaped charges and other explosive techniques

30. US and Foreign Underwater Ordnance

A. Identify

B. Observe safety precautions

31. New EOD Developments

32. General Contingency Responsibilities

A. Prime BEEF orientation

B. Field sanitation and hygiene

C. Self-protection from extreme weather

D. First aid techniques

E. Personnel/work party security

F. Convoy security

G. Air base ground defense interface

H. Passive defense

I. Terrorism

J. Base denial

H-1b(2) RCRA TRAINING PROGRAM

All EOD personnel responsible for management and operations at the 20,000-Pound OD Unit are required to complete the RCRA training program offered at Holloman AFB. The course outline is provided as Attachment H-1.

H-1c TRAINING DIRECTOR

The EOD supervisor is responsible for ensuring that assigned personnel receive adequate training in handling potentially hazardous wastes. Training directors at the EOD school in Indian Head, MD, are highly trained career specialists who provide the EOD training for all DoD personnel. ~~Instructions for the RCRA course are indicated in Exhibit H-1.~~ Records of previous and ongoing training courses are maintained at the EOD section.

H-1d RELEVANCE OF TRAINING TO JOB POSITION

The EOD supervisory personnel who will be responsible in case of an emergency have been trained in handling explosive ordnance and potentially hazardous waste and in responding to emergency situations. Each has attended the EOD school course at Indian Head Naval Ordnance Station. Completion of the RCRA training course in Attachment H-1 is also required.

H-1e TRAINING FOR EMERGENCY RESPONSE

The Naval Ordnance Station training program ensures that personnel receive emergency response training. On-the-job training requires each person to read and understand various official publications including, but not limited to:

AFR 127-100	Explosives Safety Standards
AFOSH Regulation 127-66	General Industrial Operations

Code of Federal Regulations, Title 49	Transportation
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
T.O. 00-5-1	AF Technical Order System
T.O. 11A-1-1	Ammunition Restricted or Suspended
T.O. 11A-1-42	General Instructions for Disposal of Conventional Munitions
T.O. 11A-1-46	Fire Fighting Guidance, Transportation and Storage, Management Data, and Complete Round Charts
T.O. 11A-1-53	General Instructions for Ammunition Color coding, Identification of Empty and Inert Loaded Ammo Items and Components, and Assignment of Version Numbers to Training and Dummy Ammunition Items
T.O. 11A-1-60	General Instructions for Inspection of Reusable Munitions Containers and Scrap Material Generated from Items Exposed to or Containing Explosives
T.O. 60 Series	This series is common to all military services. Various titles regarding specific items containing explosive ordnance, e.g., T.O. 60B-2-2-11-4 (Mk 106 Practice Bomb), T.O. 60F-2-2-1-7 (2.75 WP Warhead)

Additionally, EOD personnel responsible for operations at the EOD Area are provided additional training in emergency response as a portion of the Holloman AFB training program. This training includes the following applicable Air Force Occupational, Safety, and Health Standards".

AFOSH 111-1
AFOSH 127-31
AFOSH 127-38
AFOSH 127-43
AFOSH 127-66

H-2 IMPLEMENTATION OF THE TRAINING PROGRAM

The EOD supervisor and director of the Holloman AFB RCRA training program will ensure that all EOD personnel have met the training requirements within six months of this assignment at the facility. At the time of the submittal, all EOD personnel have completed the hazardous waste management portion of the training program. Training records for both the EOD and RCRA portions of the program are maintained at the EOD and Environmental Planning Branches.

Annual reviews and updates are required for both the EOD and hazardous waste management portions of the program. Records that specify the job title, duties, and progression in the training programs are maintained at the EOD branch. These records are maintained during tenure of the personnel at Holloman AFB.

Attachment H-1
Hazardous Waste Training Outline

Attachment H-1
Hazardous Waste Training Outline

1. This training is provided primarily to accumulation/satellite accumulation point managers. This course is designed to fulfill, in part, the requirements of 40 CFR 265.16. It is not intended to fulfill the requirements of 29 CFR 1910.120.

2. The following material is covered during the class:

A. Introduction to RCRA

B. Definition of Hazardous Waste
- characteristics
- listed wastes

C. Accumulation point managers

D. Container use, marking, labeling and on base transportation

E. Contingency planning and emergency response.

SECTION G

CONTINGENCY PLAN

The information provided in this section is adopted from the Holloman AFB ~~Spill Prevention and Response Plan, Holloman AFB Regulation 136-2~~ Base Civil Engineer Contingency Response Plan. The plan is divided into ~~six~~ seven sections that identify:

- overall mission;
- designated parties and their responsibilities;
- ~~spill prevention, control, and countermeasures~~ emergency response, control, and countermeasures;
- contingency plan requirements and actions;
- contingency training; and
- plan review and update.

Additionally, the ~~Spill Prevention and Response Plan~~ Contingency Response Plan provides a series of annexes that identify contingency requirements for specific and other nonspecific base locations. Annex ~~II-8~~ D-1-B is primarily used in conjuction with the sections of the ~~Spill Prevention and Response Plan~~ Contingency Response Plan indicated above in response to emergencies ~~at these locations~~ involving the OD Unit. The Contingency Response Plan is kept updated by Holloman AFB and provides guidelines for dealing with hazardous waste-related emergencies. Additionally, an OD Unit-specific contingency plan is provided in Attachment G-1.

G-1 GENERAL INFORMATION

~~OB/OD operations occur at three location on Holloman AFB identified as the EOD training range, moving trench, and test tract. Accordingly, contingency information is provided for these three locations.~~

The contingency plan will continually be reviewed and revised if any of the following occur: the facility permit is revised; the plan is inadequate in an emergency; the procedures herein can be improved; facility operations change in a way that alters the plan; the emergency coordinator changes; or the emergency equipment list changes. Amendments to this plan can be initiated by any responsible party. Proposed changes may be submitted to ~~49 CES/CEV~~ the 49th Civil Engineering Squadron (49 CES) as the office with primary responsibilities to represent ~~the permit holder~~ both EOD personnel and other contingency response personnel. Adopted changes will be provided to all record holders of this permit application.

Copies of the plan are available at the Holloman AFB civil engineering office and the base EOD office.

The facility name, address, ID number, and owner/operator are provided below:

- Name: Holloman
- Owner: United States Air Force
- Operator: 49 CES/CEV
- EPA ID No: NM6572124422

~~16 A copy of the topographic map included in Figure B-4shows the area surrounding the unit. Figure B-3 designates the location of the unit relative to the main base area.~~

G-1 EMERGENCY COORDINATORS

The emergency coordinators will coordinate and direct control and cleanup efforts at the scene in case of an incident involving the transportation, handling, or demolition of explosive waste items. The emergency coordinators can designate other personnel to assist them in the event of an emergency and have the full authority to obtain fire and medical support service should the need arise.

Prior to operations by EOD personnel, the EOD supervisor contacts the following base offices: meteorology, munitions, medical services, security police, base operations,

Environmental Coordinator, and the fire chief. ~~and the NMED.~~ Therefore, the capabilities of these organizations are alerted in the event that potential emergencies occur during EOD treatment operations.

The primary on-scene coordinator (OSC) for Holloman AFB is the Commander, 49th Support Group. The title and work phone number of the primary OSC and designated alternates are provided below:

Title	Base Phone No.
Commander	5541
Base Civil Engineer	3071
~~Base fire Chief~~	~~1117~~
Chief of Maintenance Engineering	5038
Chief of Readiness Flight	3066
Command Post	7575

G-3 IMPLEMENTATION

The decision to implement the Contingency Plan for the unit depends upon whether an imminent or actual incident could threaten human health or the environment. The purpose of this section is to provide guidance to the emergency director in making this decision by providing decision-making criteria.

The Contingency Plan will be implemented in the following situations:

- An unplanned fire or unplanned explosion occurs at the OD Unit such that:

  - the potential for human injury exists;

  - toxic fumes that could endanger human health or the environment are released;

  - the fire could spread on-site or off-site and possibly ignite other flammable materials or cause heat-induced explosions;

  - the use of water and/or chemical fire suppressants could

result in contaminated runoff that could endanger human health or the environment; or,

- an imminent danger exists that an explosion could ignite other hazardous wastes at the facility and possibly result in the release of toxic material.

- A spill or unplanned release of hazardous material occurs at the unit such that:

  - the spill could cause the release of toxic liquids or fumes that could endanger human health or the environment;

  - the spill cannot be contained in the immediate areas resulting in potential off-site soil contamination and/or ground or surface water pollution that could endanger human health or the environment; or,

  - the spilled material inadvertently detonates or combusts.

- A fire or explosion occurs during transport of the waste or residuals to or from the unit.

- A planned treatment event results in:

  - damage to the unit beyond that normal to such treatment event and such that release is imminent; or

  - ignites any structure, road surface, etc. in the vicinity.

- During rupture of a cylinder, the cylinder is released from its securing device.

G-4 EMERGENCY RESPONSE PROCEDURES

G-4a NOTIFICATION

The EOD team members discovering a potential emergency incident at any of these units will notify Range Control. The Range Control Supervisor will, in turn, notify the OSC or alternate. The OSC or alternate will immediately activate the internal alarm system to notify or evacuate personnel, if appropriate. In addition, the OSC or alternate

will notify the Base Fire Chief, Environmental Coordinator, Base Civil Engineer, Chief of Operations, Readiness Flight, Material Management, Engineering and Environmental Flight, Public Affairs, and Medical Services as required.

The appropriate local agencies with designated response roles will be notified by the OSC if their help is needed. The appropriate state agencies will be notified if their assistance is needed, or the incident requires reporting at this level.

The evacuation routes to be used in the event of an emergency, ~~noted in Section G-3,~~ are the unit entrances, provided that the extent of the incident is limited to the immediate vicinity but temporary evacuation is required. Evacuation from the main base area, if required, is designated in the Holloman AFB Contingency Response Plan. ~~Disaster Plan 355-1, Disaster Preparedness. Notification and evacuation are further addressed in the Spill Prevention and Response Plan (Exhibit G-1) and Disaster Plan 355-1 (Exhibit G-2).~~

G-4b IDENTIFICATION OF HAZARDOUS WASTES

The OSC will immediately identify the character, exact source, amount, and a real extent of the material involved in the unplanned incident. The initial identification method will be by visual inspection of the incident's effects, spilled material, and location of the release. Plan records, including inventories and process and waste log sheets, are available at the EOD and Base Environmental Coordinator's office to aid in estimating the composition and quantity of released material. Base Bioenvironmental Engineering will sample to verify hazardous material identification, to determine boundaries of contaminated areas and contaminant concentrations, and to verify proper cleanup activities are completed.

Resources such as plant storm-line diagrams and material-storage locations are available at the Base Operations office and will be utilized to determine control procedures.

G-4c HAZARD ASSESSMENT

Possible hazards to the environment and public health will be assessed by the OSC, and the need for local evacuation and notification of local authorities will be determined. In assessing the situation, the OSC will consult with the Environmental Coordinator, Bioenvironmental Engineer, and Base Fire Chief. These parties will consider both direct and indirect effects of the event on human health, welfare, and natural resources. In assessing the event, the potential for direct and indirect effects shall indicate, but not be limited to, fire, explosion, further release occurrence, toxic gases, or injection by runon and runoff. ~~The following portions of the Spill Prevention and Response Plan are referred to for this assessment: Annex I, Annex II-8, Annex III and Annex VI.~~ Action will be taken to control releases and minimize effects during such an emergency, if the situation involves the release or potential release of toxic effluents.

The OSC (in conjunction with the noted personnel) will determine whether the OD Unit has had a release which could threaten human health or the environment outside the base. Bioenvironmental Engineering will survey the area and advise the OSC in the establishment of protective boundaries around the contaminated areas.

If a release results in a vapor cloud, several methods are available for assessing the hazards. Portable equipment for direct air monitoring can be used to make a rapid determination of the most volatile organics.

Meteorological data, including wind speed, wind direction, temperature, dew point, barometric pressure, and an automatically-calculated stability factor are continuously available from base meteorological towers. These data, along with information about the source of an atmospheric release, can be used to predict the direction, extent, and estimated concentration profile of a contaminated release.

If the assessment of the incident indicates that evacuation of areas downwind of the unit may be advisable, the OSC will immediately notify HQ ACC/CEV and the appropriate local authorities. He will consult with these officials to help decide whether local areas should be evacuated. The OSC or the Environmental Coordinator will immediately notify the National Response Center (using their 24-hour toll free number, 800-424-9902).

G-4d CONTROL PROCEDURES

Potential accidents at the OD Unit can be considered either unplanned fire/explosion, inadvertent facility damage, or spill material release. Natural disasters such as earthquakes, hurricanes, or tornadoes are not assumed to cause actions which fall into one of these categories. Procedures for responding to these incidents are contained in the ~~Spill Prevention and~~ Contingency Response Plan, Disaster Preparedness Plan, and TO 11A-1-60. Specific actions to be taken at these units include:

- Ordnance Transportation Vehicles

  - Explosion. In the event of an explosion, personnel will immediately withdraw to a safe distance and evaluate the situation. NOTE: This does not apply to detonation during transport which requires immediate implementation of the referenced ~~Spill Prevention and~~ Contingency Response Plan and Disaster Plans. Heavy-bodied trucks have been specifically chosen for this task due to the inherent risk associated with these materials. Transport limits and requirements are specified in relevant EOD technical orders.

  - Fire. In the event of a fire involving a transport vehicle with ordnance on-board, an attempt to control the fire with available extinguishers may be permissible if the fire is initially away from the ordnance. If not, personnel will withdraw to a safe distance and advise appropriate authorities.

- Material Spill. In the event of a diesel fuel spill, shovels will be used to construct a dike around the spill to contain lateral movement. As much free liquid as possible will be returned to the container. The fuel-soaked soil will be excavated and placed in impervious recovery containers for transportation to an approved disposal location. The Base Environmental Coordinator will be contacted for disposal information.

G-4e PREVENTION OF RECURRENCE OR SPREAD OF FIRES, EXPLOSIONS, OR RELEASES

The Holloman ~~Spill Prevention and~~ Contingency Response Plan should be referenced for this information. At a minimum, follow-up actions will include:

- Start actions to collect, treat, and dispose of nonexplosive waste or other materials as appropriate. This will be a joint operation involving EOD, Fire, and Bioenvironmental Engineering personnel.

- Ensure that EOD, Fire, and Safety personnel investigate the cause of the emergency and provide a technical report to the Commander, 49th Support Group within 72 hours.

- Ensure that proper restoration actions are started as soon as possible after appropriate explosives decontamination procedures have been completed. This will be a joint operation between Safety and Civil Engineering personnel for Air Force incidents. All decontamination actions will be documented and the records permanently maintained at Air Force EOD, Safety, and Real Estate offices.

- Ensure that equipment repaired or replaced as a result of the incident is recertified, as necessary, prior to being placed.

G-4f STORAGE AND TREATMENT OF RELEASE MATERIAL

~~The Spill Prevention and Response Plan should be referenced for this information.~~ The storage and treatment of any release material will be managed in accordance with the Holloman Contingency Response Plan.

G-4g POSTEMERGENCY EQUIPMENT MAINTENANCE

~~The Spill Prevention and Response Plan should be referenced for this information.~~ Post-emergency equipment maintenance will be performed in accordance with the Holloman Contingency Response Plan.

G-4h CONTAINER SPILLS AND LEAKAGE

Any container spills or leakage which might occur at these units will be managed in accordance with the Holloman Contingency Response Plan.

G-4i TANK SPILLS AND LEAKAGE -- Not Applicable.

G-4j WASTE PILE SPILLS AND LEAKAGE -- Not Applicable.

G-4k SURFACE IMPOUNDMENTS, SPILL LEAKAGE, AND SUDDEN DROPS - - Not Applicable.

G-4l LANDFILL LEAKAGE -- Not Applicable.

G-5 EMERGENCY EQUIPMENT

These items will be available for EOD activities:

- first aid kit (NSN-654500-116-1410) or suitable substitute;
- ambulance or first aid vehicle;
- fire extinguisher: two per vehicle carrying class B/C explosives;
- hand-held radio for contact with range control;
- vehicular radio for contact with Holloman AFB;
- team chief's response kit with maps;
- road kit: one per vehicle;
- general purpose tool kit;
- signal kit;
- pioneer tool kit (if required for specific treatment event);
- road flares;
- shovels: two per vehicle; and
- bulldozer.

G-6 COORDINATION REQUIREMENTS

In addition to the base organizations and personnel assigned to the response effort, provisions have been made for including off-base organizations in the response organization when on-base ~~spill~~ response resources and expertise are insufficient, and when off-base water, land, or air are adversely affected. Some of the significant off-base ~~spill~~ response resources that can be incorporated, as needed, are discussed in the paragraphs below.

a. Air Combat Command (ACC/CEV): MAJCOM office responsible to ensure environmental protection including spill response matters. This office located at Langley AFB, VA and can be reached at DSN 574-2601 or commercial 804-764-2601.

b. Air Force Engineering and Services Center (AFESC): The Air Force Engineering and Services Center is assigned the responsibility to provide technical guidance and assistance to major commands and bases in contingency operations and environmental planning. Technical expertise can be provided to the Air Force OSC on hazardous material identification, control, cleanup, and disposal. The AFESC/CEVP is located at Tyndall Air Force Base, Florida, and can be contacted at DSN 970-6167 or commercial (904) 283-6167.

c. State of New Mexico Response Team: The State of New Mexico Environment Department (NMED) has developed an Emergency Response Team to respond to spills occurring within the state boundaries. The state OSC will be briefed fully by the base OSC on the spill response. The state OSC will be familiar with the available sources of spill response equipment and materials within New Mexico. The NMED emergency response team phone number is (505) 827-9329.

d. City of Alamogordo Fire Department: Holloman AFB has mutual aid agreement with the city of Alamogordo Fire Department to provide assistance in the event it should be needed.

e. White Sands Missile Range: Certain information services are also available to assist in the event of an emergency. They include:

- CHEMTREC

- CHRIS Manual
- ETRIS
- OHMTAPS
- U. S. Air Force Occupational and Environmental Health Laboratory

Further information on these services is provided in the ~~Spill Prevention and~~ Contingency Response Plan.

G-7 EVACUATION PLAN

It is extremely unlikely that emergency operation at the OD Unit would require evacuation of other areas at Holloman AFB since these units are isolated from any other area or office buildings.

The general base excavation plan is provided as part of the Disaster Preparedness Plan.

G-8 REQUIRED REPORTS

The emergency coordinator will notify the Holloman AFB Environmental Coordinator (49th CES/CEV) who will report pollution incidents as necessary.

Notification by the environmental coordinator (DEV):

1. All pollution incidents will be reported as soon as practicable (by telephone during duty hours or by message during off-duty hours) to the following agencies:

a. HQ ACC/CEV
. DSN 574-2601; commercial (804) 764-2601

b. Regional Response Center (RRC)

Environmental Protection Agency, Region VI
First Interstate Bank Tower
1445 Ross Avenue
Dallas, TX 75202-2733
(214) 767-2666/2720
Telex 910-861-4125

c. New Mexico Environment Department
1-(505)-827-9329

2. Major spills or potentially major spills will immediately reported by telephone and teletype to RRC (1.b above) and:

National Response Center
Environmental Protection Agency
Nasiff Building
400 7th Street, S.W.
Washington, D. C. 20590
1-800-424-8802
Telex 426-0014

Medium spills will be reported to the above agencies as soon as practical.

Attachment G-1
Holloman AFB OD Unit Contingency Plan

SECTION F

PROCEDURES TO PREVENT HAZARDS

This section addresses security procedures, inspection requirements, preparedness requirements, procedures taken to prevent accidental detonation, prevention of the mixing of incompatible waste, and means to reduce personnel exposure. The procedures outlined in this section are designed to ensure compliance with 40 CFR 264.601 and the general requirements of 40 CFR 264.33 and 40 CFR 264.15. A copy of the standard operating procedures (SOPs) used by the EOD personnel is included in Attachment F-1.

F-l SECURITY

This section summarizes security precautions relative to Holloman AFB and the 20,000-Pound OD Unit within the base confines. Holloman AFB is located on approximately 50,700 acres that consist primarily of unimproved property. White Sands Missile Range and White Sands National Monument bound the base to the north and south, respectively.

F-la SECURITY PROCEDURES AND EQUIPMENT

F-la(1) 24-HOUR SURVEILLANCE SYSTEM

The primary mission of Holloman AFB is to provide upgrade and continuation training for aircrews assigned to T38, F-4, and F-117A aircraft. Additionally, solid base propulsion systems for military devices are tested at the area identified as the Test Track. The general nature of these activities is such that portions of the base facility are under constant surveillance. In particular, such areas include the Test Track Facility, flight line areas, and the munitions building. In addition to these surveillance measures, the main base area and any base area adjacent to these secure zones is patrolled at intervals both day and night. ~~Traffic access to Holloman AFB is provided only by Highway 70 that traverses the southern boundary of the base and La Luz gate on the eastern boundary. Access can also be gained from White Sands Missile Range. Entrances to the base from~~

~~Highway 70 are manned by armed guards 24-hour per day. These general surveillance practices provide general 24-hour surveillance to the treatment unit.~~

Traffic access to Holloman AFB is possible three ways: Highway 70 at the southern boundary of the base; the La Luz gate between Alamogordo and Tularosa; and, through White Sands Missile Range. The two gates are manned by armed guards 24 hours per day. White Sands Missile Range is also under continuous surveillance. These general surveillance practices provide 24-hour surveillance of the treatment unit. Additionally, during detonation events, constant surveillance of the OD Unit is provided by Test Track personnel and the Security Police.

F-la(2) BARRIER AND MEANS TO CONTROL ENTRY

The 20,000-Pound OD Unit is located at the end of a single access road which runs approximately 20 miles along the length of the test track. No fence exists around the OD Unit; however, entrance to the test track area is strictly controlled by Test Track personnel and the Security Police. Entrance to these units is restricted to authorized visitors on approval of the EOD supervisor. Visitors to the unit must be accompanied by EOD personnel. No visitors are allowed during detonation events. Additionally, the treatment unit is provided with only a single entrance. During detonation events, the area is routinely patrolled to prevent access to the OD Unit.

F-la(3) WARNING SIGNS

Warning signs that indicate the controlled access nature of the treatment unit are present at the entry point to the facility boundary. The unit is posted with signs that state: "Danger, Explosive Disposal Area, Keep Out". The signs at the entrance and along the circumference of the surrounding fence of distances at intervals of 300 feet are legible at distances greater than ~~greater than~~ 25 feet. The signs are in English and Spanish.

F-2 INSPECTION SCHEDULE

F-2a GENERAL INSPECTION REQUIREMENTS

The complexity and special nature of the activities conducted at Holloman AFB result in delegation of responsibility for general inspection requirements among various groups. Corrective action for deficiencies found during these routine inspections, repair and preventive maintenance of various items of equipment, and maintenance of inspection records are also delegated among these various groups. Among the areas covered by the routine inspection and maintenance activities are:

- Fire Control Equipment: fire extinguishers, pump truck equipment (pumps, hoses, horns and sirens, etc.) fire alarms, and self-contained apparatus.

- Emergency Equipment: protective clothing, safety glasses, face shields, emergency eyewashes, chemical respirators, etc.

- Security Equipment: ~~fences, gates, locks,~~ facility lighting, signs, etc.

- Structures: road surfaces, vegetation-free zones, fireboards.

- Communication Systems: radios, base intercom, base evacuation system etc.

- Vehicular Equipment: transport vehicles.

An inspection program has been established to inspect all components of the treatment units for malfunctions, deteriorations, signs of contaminant release that indicate potential for migration of hazardous waste constituents to the environment, or the potential for human endangerment. These inspections are performed prior to treatment, after treatment, and at regular intervals during inactivity to permit the use of corrective measures that will minimize such problems.

Vehicles used to transport demolition materials, explosives, and personnel are inspected daily and inspections documented on AF Form 1800.

Table F-1 presents an example inspection schedule for inspecting safety and emergency equipment, security devices, structural equipment, communications equipment, mobile equipment, and range areas. Also listed is inspection of the clear

zones around these units for vegetation. Clearing operations of the natural vegetation are then based on these inspections.

F-2a(1) TYPES OF PROBLEMS

The inspections schedule identifies the types of problems (e.g., malfunctions or deteriorations) which are checked during inspections.

F-2a(2) FREQUENCY OF INSPECTION

Inspection of all materials, security devices, safety equipment, and communication devices will be inspected before each EOD operation. This frequency of inspection will determine equipment deteriorations and malfunctions between inspections.

Table F-1 General Inspection Schedule

Area/Equipment	Specific Item	Types of Problems	Frequency of Inspection
Safety and Emergency Equipment	Face shields and extra protective eyeglasses	Broken and dirty equipment	Monthly
	Disposable respirators	Out of stock, not required, filter types for materials being handled.	Monthly, as needed
	Fire extinguishers (Min.= 2)	In need of recharging	Monthly/after each use
	Vehicular radio; handheld radio	Inoperable	As used
	First aid equipment and supplies	Items out of stock or inoperable	As used
	Protective clothing (impermeable full body coveralls, gloves and foot coverings	Holes, thin areas, tears	As used
Security Devices	~~Facility fence~~	~~Corroded chain-fence and barbed wire, burrowing, signs of intrusion~~	~~Bi-weekly~~
	Signs	Illegible	~~Bi-weekly~~ Monthly
EOD Vehicle	Brakes	Worn pads and rotors	Prior to each treatment
	Hydraulics	Leaking	Prior to each treatment
	Horns/sirens	Inoperative	Prior to each treatment
	Trailer hitches	Loose and missing safety chains	Prior to each treatment

	General purpose tool kit	Items missing and damaged	Prior to use

	Pioneer tool kit	Items missing and damaged	Prior to use

	Demolition ordinance/initiation agents	Nonserviceable, exceeds shelf life damaged, corroded, deteriorated	Weekly, prior to use

Treatment Zone	Waste items	Inventory reconciliation	Prior to transport or treatment

	Residuals	Scattered, free-standing liquids	After treatment

	~~Trench walls~~	~~Settlement, cave-in~~	~~Before use~~

	Clear zone/general area	Vegetation, burrowing, corrosion, signs of runon/runoff	Monthly

	Firebreak	Vegetation, scrap, debris	Monthly

	Roads	Settlement, holes, ditches	Annual

F-2b SPECIFIC PROCESS INSPECTION REQUIREMENTS -- Not Applicable

F-2b(1) CONTAINER INSPECTION -- Not Applicable

F-2b(2) TANK INSPECTION -- Not Applicable

F-2b(3) WASTE PILE INSPECTION -- Not Applicable

F-2b(4) SURFACE IMPOUNDMENT INSPECTION -- Not Applicable

F-2b(5) INCINERATOR INSPECTION -- Not Applicable

F-2b(6) LANDFILL INSPECTION -- Not Applicable

F-2b(7) LAND TREATMENT INSPECTION -- Not Applicable

F-2b(8) MISCELLANEOUS UNIT INSPECTION

The inspection schedule used for the treatment unit is provided as Table F-1. This inspection plan addresses unit specific structures, emergency equipment, operational equipment, safety equipment, communications systems, transport vehicles, and the treatment zone (including the cleared area).

F-2c REMEDIAL ACTION

If inspections reveal that nonemergency maintenance is needed, then Holloman AFB personnel will initiate immediate action(s) to preclude further damage and reduce the need for emergency repairs. If a hazard is imminent, or has already occurred during the course of an inspection, or any time between inspections, then remedial action will immediately be taken. Appropriate authorities will be notified according to the Holloman Contingency Plan, Section G of this application. In the event of an emergency involving the release of hazardous constituents to the environment, efforts will be

directed towards containing the hazard, removing it, and subsequently decontaminating the affected area as outlined in the Holloman AFB Contingency Plan. The general nature of the remedial action to be taken is noted in the Inspection Log.

F-2d INSPECTION LOG

A log is kept to record inspection findings at the OD Unit as specified in TO 11A-142. The log includes spaces for the date of the inspection, identity of the inspector, and the specific items to be inspected and provides for records of remedial action.

F-3 WAIVER OF PREPAREDNESS AND PREVENTION REQUIREMENTS

No waiver is requested.

F-3a EQUIPMENT REQUIREMENTS

F-3a(1) INTERNAL COMMUNICATIONS

~~Refer to the Holloman Spill Prevention and Response (SPR) Plan for information on the alarm system at Holloman AFB~~. Personnel that enter the treatment zone for inspection of operation are provided with hand-held two-way radios. Radio contact with Track Control is maintained at all times while in the restricted area.

F-3a(2) EXTERNAL COMMUNICATIONS

External communications capabilities are provided through the base operator. Communications systems include Defense Switched Network (DSN), FTS, and the US West ~~Southwest Bell~~ System.

F-3a(3) EMERGENCY EQUIPMENT

Refer to the emergency equipment available at the treatment units during operations which includes fire extinguishers, two-way radios, and personnel protective equipment such as gloves and respirators.

F-3a(4) WATER FOR FIRE CONTROL

Water for fire control is not available at this unit. Base fire department trucks are available during operations for emergency response.

F-3b AISLE SPACE REQUIREMENTS -- Not Applicable

F-4 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT

F-4a UNLOADING OPERATIONS

Procedures to prevent incidental detonation of the waste are also applicable to spill prevention during pretreatment operations. These procedures are indicated in Section C. EOD procedures to prevent accidental detonation are detailed in TO 11A-1-42 and TO 11A-1-60. In general, these procedures specify use of nonsparking tools, encasement to reduce impact, use of certain clothing materials, and, most importantly, removal of primers and initial detonators from the device. The explosive nature of the waste indicates the greater hazard to be incidental detonation during transfer of waste into the detonation zone. None of the energetic waste contains free liquid.

F-4b RUNON AND RUNOFF

Runon and runoff is negligible because of the low precipitation amounts as discussed in Section E. ~~Runon is prevented from entering this unit by the berm surrounding the treatment area.~~ Additionally, the area surrounding the unit is inspected on a regular basis for signs of visible contamination (detonation fragments or discoloration). Detonation fragments that are discovered are collected and inspected by EOD and detonated again if necessary. for ~~signs of reactivity. If any surrounding soils exhibit signs of visible contamination, the soils will be analyzed by the protocols indicted in Section C and, if necessary, collected for disposal as hazardous waste. In addition, a complete hydrogeological survey will be completed in 1993 to assess runon and runoff affects. Results of the survey will be forwarded to NMED.~~

F-4c WATER SUPPLIES

No water lines are present in the vicinity of these units. Impacts to surrounding groundwater or surface waters are discussed in Section E.

F-4d EQUIPMENT AND POWER FAILURE

Operations at the unit will not be affected if a facility power outage occurs. None of the unit-specific equipment requires electrical power.

F-4e PERSONNEL PROTECTION EQUIPMENT

The equipment appropriate for employees at specific facilities and areas of the plant is specified by EOD orders and the bioenvironmental engineer. They consider the characteristics of the waste types to be handled, including toxicity, ignitability, reactivity, corrosivity, routes of exposure, and similar information. The bioenvironmental staff reports to the On-Site Coordinator (OSC) whenever the Contingency Plan is implemented, and they assist him in specifying the protective equipment for firefighters, rescue teams, spill cleanup personnel, equipment decontaminators etc.

Procedures to ensure safe handling of these reactive waste are detailed in TOs 11A-1-42 and 11A-1-60. All operations are performed by fully-trained EOD personnel under the direction of the EOD Supervisor. These personnel are familiar with procedures to be followed for the material being handled.

F-5 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES

F-5a PRECAUTIONS TO PREVENT IGNITION OR REACTION OF IGNITABLE OR REACTIVE WASTE

Each waste item that is destined for treatment at the unit is handled in accordance with TOs 11A-1-42 and 11A-1-60. Waste energetic items are not opened at any time due

to the potential for incidental detonation. Postdetonation residues are inspected to ensure no untreated waste remains in the zone.

F-5b GENERAL PRECAUTIONS FOR HANDLING IGNITABLE OR REACTIVE WASTE AND MIXING OF INCOMPATIBLE WASTE

The general procedures for handling these wastes are detailed in referenced TO procedures.

F-5c MANAGEMENT OF INCOMPATIBLE WASTE IN CONTAINERS-

No waste is stored at these units prior to thermal treatment.

F-5d INCOMPATIBLE WASTE IN TANKS-Not Applicable

F-5e IGNITABLE OR REACTIVE WASTES IN WASTE PILES-Not Applicable

F-5f INCOMPATIBLE WASTES IN WASTE PILES-Not Applicable

F-5g IGNITABLE OR REACTIVE WASTES IN SURFACE IMPOUNDMENTS- Not Applicable

F-5h INCOMPATIBLE WASTE IN LANDFILLS-Not Applicable

F-5i IGNITABLE OR REACTIVE WASTES IN LANDFILLS-Not Applicable

F-5j INCOMPATIBLE WASTE IN LANDFILLS-Not Applicable

F-5k LIQUID WASTES IN LANDFILLS -Not Applicable

F-5l SPECIAL REQUIREMENTS FOR CONTAINERS DISPOSED IN LANDFILLS -Not Applicable

F-5m IGNITABLE OR REACTIVE WASTES IN LAND TREATMENT -Not Applicable

F-5n INCOMPATIBLE WASTE IN LAND TREATMENT -Not Applicable

As indicated in Sections C and D, the general formulation of these items incorporates multiple energetic compounds in a manner known as a “Detonation Train”. Additionally, the compounds are often commingled in binary or tertiary explosive formulations. For this reason, some of the energetics that are combined exhibit incompatibility under normal conditions.

Attachment F-1

OD Unit Standard Operating Procedures

SECTION E

ENVIRONMENTAL PERFORMANCE STANDARDS

This section provides a detailed description of environmental, geological, and hydrogeological conditions at the Holloman AFB 20,000-Pound Open Detonation Unit (OD Unit), in accordance with the requirements of various provisions specified under NMHWMR-7, Parts V and IX, and 40 CFR 264.601 and 270.14.

Three investigative reports prepared for Holloman AFB in 1992 and 1993 were used as references for preparation of the Environmental Performance Standards. The three reports referenced are the *Remedial Investigation (RI) Report, Volume I - Text and Plates, Investigation, Study, and Recommendation for 29 Waste Sites, Radian Corporation, October 1992.*, the *20,000# EOD Soil and Water Investigation, ICF Kaiser Engineers and Labat-Anderson, Inc., August 1993*, and the *Base-Wide Background Study, Sewage Lagoons and Lakes Investigation, Holloman Air Force Base, Radian Corporation, December 1993.* An OD Unit site location map is presented in Figure E-1.

E-1 SUBSURFACE ASSESSMENT

E-1a VOLUME AND CHARACTERISTICS OF THE WASTE

This section provides a brief discussion of the wastes that are treated at the OD Unit and the thermal treatment process that is utilized. The volume and a more detailed description of the characteristics of the wastes thermally treated at the OD Unit are presented in Section C.

The wastes treated at the OD Unit are generally propellant devices and explosives with expired shelf lives. Rocket motors are regularly treated at the OD Unit. The energetic materials contained in the wastes described above are considered

Figure E-1. OD Unit Site Map (modified from Labat-Anderson, 1993)

characteristically hazardous on the basis of reactivity (D003) as these materials deflagrate or detonate when subjected to shock or heat. The total mass of the energetic material is typically limited to less than 10,000 pounds per device.

These waste munitions are transported to the OD Unit in their original containers or casings, which are designed for long-term stability and thus ensure that no wastes are inadvertently released to the environment prior to treatment. In addition, no free liquids are included among the wastes treated at the OD Unit. Free liquids in waste have a much higher potential of infiltrating into the soil and migrating vertically.

All OD Unit waste treatment activities are conducted on the ground surface. No trenches or pits are excavated to contain the wastes. Detonation charges that consist of RDX explosive are added to the waste pile in order to detonate the wastes. The OD operations are conducted within a single graded area at the OD Unit (approximately 400 feet in diameter), as described in Section D. Potential contaminants which may be released during thermal treatment are generally limited to trace amounts of explosive compounds or metals. The thermal treatment process generally ensures complete destruction of the wastes. After a detonation, any unexploded fragments of the original ordnance are collected and re-exploded to further ensure that complete destruction of the original waste ordnance has occurred. Larger metallic fragments are picked up after each detonation for proper disposal. Because the wastes are treated on the ground surface, a thorough collection of the waste fragments is possible.

Residual waste munition compounds become nonhazardous once detonation occurs. Organic constituents of the wastes are converted to gaseous products such as CO, CO_2, and N_2 during thermal treatment thereby eliminating the hazardous characteristics of the wastes.

The metal debris remaining after thermal treatment of the wastes

is typically present in elemental states or as oxides that are insoluble or of limited solubility in water (see Table C-3), thus eliminating the potential for metallic compounds to migrate through the soil or into surface water or groundwater.

E-1b HYDROGEOLOGIC CHARACTERIZATION

Holloman AFB is located within the northern Chihuahuan Desert, in the region known as the Tularosa Basin. The basin is approximately 120 miles long and bounded 8 miles to the east by the Sacramento Mountains and 20 miles to the west by the San Andres Mountains. The basin was formed when the surrounding mountains were uplifted, creating an elongated, faulted valley known as a graben. Elevations within the Tularosa Basin range from 4400 feet above mean sea level (MSL) at the northeast corner to 4000 feet MSL in the southwest corner. The OD Unit is located down slope of the Sacramento Mountains at an approximate elevation of 4100 feet MSL.

A generalized geologic cross-section of the present-day Tularosa Basin is presented in Figure E-2. The surrounding Sacramento and San Andres Mountains are composed of Precambrian to Permian granite, limestone, dolomite, and gypsum with interbedded clays, sands, and gravels. Eroded sediments from these mountains were deposited by streams, filling the Tularosa Basin. Since these sediments were carried by water into a closed basin they are called bolson deposits. These bolson deposits are approximately 4,000 feet thick in the vicinity of Holloman AFB. Only the uppermost bolson deposits are of significance to this permit application.

Groundwater occurs in unconfined conditions in the unconsolidated bolson deposits beneath Holloman AFB. The primary source of recharge for groundwater in the bolson fill is percolation of rainfall and stream runoff through the coarse, unconsolidated alluvial fan deposits along the western flank of the Sacramento Mountains. Water migrates downward into the bolson fill and flows downgradient through progressively

Figure E-2. Generalized Geologic Cross Section of the Tularosa Basin

finer-grained sediments into the basin. The hydraulic gradient is steep along the recharge zones at the base of the mountains, but then flattens out as groundwater migrates into the valley. Groundwater discharge occurs either through evapotranspiration, springs or seeps along steep-sided arroyos, or into closed playa lakes such as Lake Lucero, the regional groundwater discharge area approximately 30 miles southwest of the OD Unit. The regional groundwater flow beneath the OD Unit is southwesterly toward the center of the basin.

E-1b(1) DEPTH TO UPPERMOST SATURATED ZONE

The depth to the uppermost saturated zone decreases from 270 feet BGS (or more) near the base of the mountains to less than 40 feet BGS at Holloman AFB. Normal, seasonal water table fluctuations of up to 2.58 feet have been measured at Holloman AFB with the water table standing higher in the spring than in the fall. The water table depth beneath the OD Unit ranges from approximately 27 to 31 feet BGS.

E-1b(2) ESTIMATED ANNUAL RECHARGE

Low annual precipitation rates coupled with the high evapotranspiration rate means that there is minimal infiltrating water into the subsurface.

The annual precipitation at Holloman AFB averages 7.9 inches, with annual extremes from 2.5 inches to 13.5 inches. The mean annual lake evaporation rate, commonly used to estimate the mean annual evapotranspiration rate, averages an estimated 67 inches per year. The annual net precipitation for the area is approximately -59 inches per year.

E-1b(3) SUBSURFACE CHARACTERIZATION

E-1b(3a) SOIL CHARACTERISTICS

Subsurface soils were investigated in 1993 during installation of four monitoring wells (HAFB/EOD-MW01, 02, 03, and 04) near the OD Unit (See Figure E-1). Lithologies encountered during the investigation are presented in a generalized geologic log (Table E-1) and illustrated in a geologic cross-section of the OD Unit (Figure E-3).

An analysis of the geologic cross-section presented in Figure E-3 shows a slight change in depositional environments across the OD Unit. The thickest sequence of silty clay (playa-lacustrine deposits) is shown in HAFB/EOD-MW01, while HAFB/EOD-MW-02 shows the thickest sequence of sand and silty sand mixtures (eolian deposits). The eolian deposits are predominantly interdune deposits consisting of fine sand and silt. Below 30 feet the geologic interpretation becomes more complex. The geologic logs show lithologic changes across the site between silty clay, silty sand, and sand at the downgradient wells (HAFB/EOD-MW-02, 03, and 04). Meanwhile, the upgradient well (HAFB/EOD-MW01) shows massive silty clay with stringers or lenses of sand. It is highly probable that these sand zones are interconnected.

The cross-section shows that the top of the water table at HAFB/EOD-MW01 is located within the upper portion of the silty clay. The wells to the south and southwest show that the top of the water table is within the eolian sediments, above the silty clay. This indicates that the downgradient wells are in coarser grained material, with greater permeability and porosity.

At all four monitoring well locations near the OD Unit, there is a low permeability silty/silty clay unit between about 10 to 15 feet deep. This unit ranges from approximately 2 to 7 feet thick.

Figure E-3. Geologic Cross Section of the OD Unit Area (after Labat-Anderson, 1993)

Table E-1

Generalized Geologic (Soil Boring) Log[1]

Depth	Generalized Description
0 and 10 feet	**SAND** - Light tan, yellowish tan and light brown fine grained well sorted sand with layers of silt-sand, porous, loose to slightly firm and dry to trace moisture present. This upper zone represents eolian type deposits. The sands are most likely dunes and the silt-sand represent an interdune sequence.
10 to 12 feet (Extends to 16 feet at HAFB/EOD-MW02)	**SILT to SILTY CLAY** - Reddish brown (HAFB/EOD-MW02 also had alternating layers of gray green and light gray to white), slightly firm, low to moderately plastic and dry to trace moisture. Most likely represents a small playa at the site [2,3]
12 to 30 feet (Extends to 40 feet at HAFB/EOD-MW02)	**SAND** - Light tan, yellowish tan and light brown with reddish brown and brown layers, predominantly a fine grained, well sorted sand and with occasional layers of medium to coarse grained sands slightly firm to firm and trace moisture present.
30 to 50 (HAFB/EOD-MW02 starts at 40 feet)	**SILTY CLAY with interbedded SAND** - A gradational change of depositional environments can be observed in the logs. Reddish brown silty clay representing playa/lacustrine deposits[2] with dune and interdunal deposits merge in and out of the clay, or back and forth across the playa. The occasional thin layers of sand in the larger clay units may represent wind blown particulate across the playa or an occasional sheet flood that are common in this type of environment. The clay deposits are thickest at HAFB/EOD-MW01. These deposits are reddish brown silty clay with light gray or green gray mottling[4] in the upper 2 feet, moderate to high plasticity, slightly firm to firm, ranging in moisture from trace to wet. At 50 feet, 1 to 2 mm gypsum crystals were found. Sands found below 30 feet are fine to medium grained, medium grain predominant. At HAFB/EOD-MW02 flowing sands were encountered at 42 feet.

[1] Modified from ICF Kaiser and Labat-Anderson, 1993.

[2] The reddish brown color associated with the playas are common and suggest an oxidizing environment of the iron present in the sediments. The coloration may also imply well drained soils.

[3] Poorly drained soils which are saturated most of the time are generally gray in color, because the iron has been reduced or removed. This is true for humid climates, however, not always true in arid environments.

[4] A mottled gray and reddish brown color suggests the subsoils are subjected to alternating or seasonal periods of saturation.

E-1c EXISTING GROUNDWATER QUALITY

Overall water quality in the Tularosa Basin varies with the distance from the recharge areas. Regions of groundwater recharge near the mountain escarpments have the best water quality. Wells installed in the alluvial fans that surround the valley floor are used for domestic and agricultural purposes. Water percolating through sediments high in gypsum, limestone, and dolomite becomes highly mineralized. Groundwater in the Tularosa Basin beneath Holloman AFB contains concentrations of total dissolved solids (TDS) ranging from 3,100 milligrams per liter (mg/L) to 41,000 mg/L. Sulfate concentrations range from 1,700 mg/L to 6,700 mg/L. In general, the high concentrations of TDS and sulfate in the Tularosa Basin make groundwater unusable for domestic or agricultural water supplies and can be classified as Class III B groundwater (not considered a source or potential source of drinking water) under EPA guidelines.

At the OD Unit, groundwater samples were collected from the four wells (HAFB/EOD-MW01, 02, 03, and 04) installed during the 1993 OD Unit investigation and submitted for laboratory analysis. TDS, chloride, and sulfate concentrations at the OD Unit were all found to exceed New Mexico Human Health Standards (NMHHS). TDS, sulfate, and chloride analytical results from the OD Unit monitoring wells are presented in Table E-2 below.

Table E-2
Summary of Groundwater Results from 1993 OD Unit Investigation

Constituent	Concentration Range (mg/L) (OD Unit Monitoring Wells)	NMHHS (mg/L)
TDS	5,050 - 5,700	1,000
Sulfate	3,330 - 4,100	600
Chloride	565 - 628	250

According to the New Mexico Water Quality Control Commission Regulations (NM WQCC 82-1, as amended through August 18, 1991, Parts 3-100 through 3-103), the groundwater below the OD Unit is designated as unfit for human consumption because it

exceeds NMHHS for TDS, sulfate, and chloride. Furthermore, based on the Base-Wide Background Study (Radian, 1993), the upper tolerance limit for selenium also naturally exceed the NMHHSs for groundwater.

E-1d GROUNDWATER DIRECTION AND FLOW RATE

Based on groundwater elevation measurements collected in May 1993, the direction of groundwater flow beneath the OD Unit is to the southwest. An OD Unit groundwater contour map is presented in Figure E-4. The hydraulic gradient shows that the groundwater drops one vertical foot for every 41.4 feet traversed horizontally. No surface features were found to have an effect on the groundwater flow direction.

Four aquifer slug tests were conducted in the four wells installed during the May 1993 OD Unit investigation (HAFB/EOD-MW01, 02, 03, and 04). The data collected were from rising head tests. The Bouwer and Rice analytical method was chosen to analyze the hydraulic conductivity. The computer generated hydraulic conductivity results are presented below:

- HAFB/EOD-MW01 = 2.42 x 10-4 ft/min.;
- HAFB/EOD-MW02 = 5.30 x 10-4 ft/min.;
- HAFB/EOD-MW03 = 1.03 x 10-4 ft/min.; and
- HAFB/EOD-MW04 = 1.46 x 10-4 ft/min.

Groundwater flow velocity was calculated using a basic advective transport equation derived from Darcy's Law. To compensate for the increasing hydraulic conductivity values southwest of the OD Unit, an average hydraulic conductivity was

Figure E-4. Potentiometric Groundwater Surface Map at the OD Unit (modified from Labat-Anderson, 1993)

calculated between the finer grained material (HAFB/EOD-MW01, 03, and 04) and the coarser grained material (HAFB/EOD-MW02). Using an average hydraulic conductivity value of 3.47 x 10^{-4} feet/minute, a groundwater flow velocity of 2.79 x 10^{-5} feet/minute was calculated. Groundwater at this velocity will flow approximately 14.7 feet per year to the southwest.

E-1e PROXIMITY TO GROUNDWATER WITHDRAWAL POINTS

No water supply wells are located on Holloman AFB because of the poor water quality. Base potable water supplies are obtained from Bonita Lake and from 21 wells in three separate well fields (Boles, San Andres, and Douglas) located on the western slope of the Sacramento Mountains approximately 10 miles east of Holloman AFB. Production wells in that area intercept groundwater at depths ranging from 250 to 300 feet BGS. The nearest production well downgradient of Holloman AFB is a livestock well located approximtely 3.5 miles southwest of the Base. No other downgradient or near-Base potable or irrigation wells exist.

Other chief water users in the Tularosa Basin include the city of Alamogordo and White Sands Missile Range Headquarters. The city of Alamogordo obtains its water from several sources including: Lake Bonita, 60 miles northeast of the basin; developed springs in La Luz, Alamo, and Fresnal Canyons in the Sacramento Mountains; and from wells drilled in alluvial fan deposits at the base of the Sacramento Mountains between Alamogordo and La Luz (located more than 10 miles southeast of the OD Unit).

White Sands Missile Range obtains its fresh water supply from alluvial deposits between the Organ and San Andres Mountains, and along the mountain front on the west side of the basin.

E-1f POTENTIAL IMPACTS ON HUMAN HEALTH

This information is not required for this permit application because the uppermost saturated zone (or hydraulically connected saturated zones) is not used as a drinking water supply. Because the groundwater beneath the OD Unit exceeds NMHHSs for TDS, sulfate, and chloride, the groundwater is designated as unfit for human consumption based upon New Mexico Water Quality Control Regulations.

E-1g POTENTIAL IMPACTS ON SUBSURFACE PHYSICAL STRUCTURES AND FOOD CHAIN CROPS

This information is not required in this permit application because there are no downgradient or near-Base irrigation wells. In addition, corrosive wastes are not generated at the OD Unit and there are no physical structures present that may be affected by potential corrosive wastes migrating with groundwater.

E-1h POTENTIAL IMPACTS ON WILDLIFE, DOMESTIC ANIMALS, AND VEGETATION

Because of the high negative rate of net annual precipitation (approximately -59 inches) and the unsuitability of the uppermost saturated zone as a drinking or irrigation water source, this information is not required for this permit application.

E-1i LAND USE PATTERNS

The OD Unit is located wholly within Holloman AFB. No agricultural, commercial, residential, or industrial development zones are located in the vicinity of the OD Unit. The OD Unit is situated on barren grassland and only mission-related industrial activities (e.g., the test track) are located near the OD Unit. Access to the OD Unit is tightly controlled, because of the hazards and security requirements associated with the OD Unit and the High Speed Test Track. Clearance to enter the area must be obtained from the Base test track personnel. Because of the remoteness of the site and the restricted access requirements, the likelihood that the site has been or will be used for purposes other than OD Unit activities is extremely low.

E-1j ASSESSMENT OF GROUNDWATER MIGRATION POTENTIAL

This section presents information on the potential for migration of contaminants within the uppermost saturated zone. In summary, migration of contaminants within the uppermost saturated zone is considered negligible because of the following:

- An approximate groundwater flow velocity of 14.7 feet per year and hydraulic conductivity values averaging 3.47×10^{-4} units suggest an extremely low

potential for hazardous waste contaminant migration in the uppermost saturated zone. Contaminants seldom move at the advective transport velocity of groundwater and generally move at much slower rates because of adsorption to soil particles and other processes;

- Natural TDS, chloride, and sulfate concentrations at the OD Unit all exceed New Mexico Human Health Standards (NMHHS). According to the New Mexico Water Quality Control Commission Regulations (NM WQCC 82-1, as amended through August 18, 1991, Parts 3-100 through 3-103), the groundwater below the OD Unit is designated as unfit for human consumption because it exceeds NMHHS for TDS, sulfate, and chloride. Furthermore, based on the Base-wide Background Study (Radian, 1993), the upper tolerance limit for selenium also naturally exceeds NMHHSs for groundwater;

- No water supply wells are located on the Base due to poor water quality. The nearest well of any kind is a livestock water supply well located 3.5 miles southwest of the Base; and

- There is no risk associated with the groundwater in the vicinity of the OD Unit since the resource is not used as a domestic, industrial, or agricultural water supply.

E-2 SURFACE MEDIA ASSESSMENT

E-2a VOLUME AND CHARACTERISTICS OF THE WASTE

These were previously described in Sections E-1a and C.

E-2b CONTAINMENT FACILITIES

No containment facilities exist at the OD Unit.

E-2c HYDROLOGICAL CHARACTERISTICS

Surface water resources within the Tularosa Basin are limited by the high evapotranspiration rate and low annual rainfall. Surface water is either lost to evaporation, transpiration, and infiltration or collects in the lowest point in the basin at or near Lake Lucero, located at the southwest edge of the gypsum dune field approximately 30 miles southwest of the OD Unit. The Base is crossed by several southwest trending

arroyos or draws which control surface drainage in the undeveloped part of the Base (including the OD Unit area). Surface drainages near the OD Unit include the Allen Draw, the Reagan Draw, and the Guilez Draw (see Figure B-3). Surface flow is only associated with infrequent heavy rainfall or snow melt events. The OD Unit is located on relatively flat terrain far above the 100-year floodplain boundaries.

The U.S.D.A. Soil Conservation Service has identified two soil associations in the vicinity of Holloman AFB: the Holloman-Gypsum Land-Yesum complex and the Mead silty clay loam. The Holloman-Gypsum Land-Yesum complex is representative of the surface soil found throughout the Base (including the OD Unit area). The soils of this association are formed from alluvial and eolian (wind blown) gypsiferous sediments. The Holloman unit makes up about 35% of the complex. It is a very fine grained sandy loam with a high gypsum content. The soil is moderately permeable, calcareous, and mildly alkaline. The Gypsum Land unit makes up about 30% of the complex. It is soft to hard gypsum, typically overlain by less than one inch of very fine sandy loam. The Yesum unit, which makes up approximately 20% of the complex, is a very fine sandy loam that is also high in gypsum. It is moderately permeable, calcareous, and mildly alkaline.

E-2d PRECIPITATION PATTERNS

The annual precipitation at Holloman AFB averages 7.9 inches, with annual extremes from 2.5 inches to 13.5 inches. The mean annual lake evaporation rate, commonly used to estimate the mean annual evapotranspiration rate, averages an estimated 67 inches per year. The annual net precipitation for the area is approximately -59 inches per year. Meteorological data for Holloman AFB is presented in Table E-3.

E-2e GROUNDWATER DATA

A hydrogeologic description of the unsaturated zone, saturated zone, depth to the uppermost saturated zone, rate of groundwater flow, and groundwater quality is presented in Section E-1.

E-2f PROXIMITY TO SURFACE WATERS

Surface water resources within the Tularosa Basin are limited by the high evapotranspiration rate and low annual rainfall. The majority of surface water in the basin is either lost to evaporation, transpiration, and infiltration or collects in the lowest point in the basin at or near Lake Lucero, located at the southwest edge of the gypsum dune field approximately 30 miles southwest of the OD Unit. There are no surface water resources in the vicinity of the OD Unit.

Table E-3. Meteorological Data from Holloman AFB

E-2g WATER QUALITY STANDARDS AND USE

No water quality standards apply for the intermittent surface flows that result from precipitation events.

E-2h WATER QUALITY DATA

Water quality data are not applicable for the intermittent surface flows that result from precipitation events.

E-2i LAND USE PATTERNS

Local land use patterns for the area surrounding the OD Unit are discussed in Section E-1i.

E-2j IMPACTS ON HUMAN HEALTH

The potential for adverse impacts to human health from OD Unit activities is extremely low for the following reasons:

- The OD Unit is located in a very remote area far from any human receptors;
- Groundwater in the uppermost saturated zone is unfit for human consumption. No water supply wells are located on the Base due to poor water quality. The nearest well of any kind is a livestock water supply well located approximately 3.5 miles southwest of the Base; and
- Surface water flows are infrequent due to low annual rainfall and high evapotranspiration rate (-59 inches annually) in the basin. There are no human receptors in the vicinity of the OD Unit for any surface water flows that do occur.

E-2k POTENTIAL IMPACTS ON WILDLIFE, DOMESTIC ANIMALS, AND VEGETATION

No livestock, horticultural, or silvicultural operations are conducted in the vicinity of the OD Unit. The primary vegetation around the OD Unit is native sagebrush and chaparral bush. The basal area of these bushes may become singed or burned in the immediate vicinity of the OD Unit as a result of OD Unit activities.

In the unlikely event of migration of waste constituents by surface water transport, some extremely limited impact upon native wildlife species could potentially occur through use of nearby waters as a drinking water source or from surface contact. The probability of this scenario is extremely low because of the relative insolubility of the OD Unit waste constituents following thermal treatment and the infrequency of surface water flows due to low rainfall and high evapotranspiration rates.

E-2l ASSESSMENT OF SURFACE WATER MIGRATION POTENTIAL

Assessment of the factors presented in Section E-2 indicates that the potential for migration of OD Unit waste constituents by surface water transport is negligible for the following reasons:

- Surface water flows are infrequent due to low annual rainfall and the high evapotranspiration rate (approximately -59 inches annually) in the basin. There are no human receptors in the vicinity of the OD Unit for any surface water flows that do occur;

- There are no surface water resources in the vicinity of the OD Unit. Since the Tularosa Basin is a closed basin with no surface water outlet, the majority of surface water is lost to evaporation, transpiration, and infiltration, or collects in the lowest point in the basin, Lake Lucero. Lake Lucero, the nearest permanent surface water resource to the OD Unit, is located approximately 30 miles southwest of the OD Unit;

- Waste munitions are transported to the OD Unit in their original containers or casings, which are designed for long-term stability and thus ensure that no wastes are inadvertently released to the environment prior to treatment. In addition, no free liquids are included among the wastes treated at the OD Unit;

- The OD Unit thermal treatment process generally ensures complete destruction of the waste. Residual waste munition compounds become nonhazardous once detonation occurs. Organic constituents of the wastes are converted to gaseous products such as CO, CO_2, and N_2 during thermal treatment thereby eliminating the hazardous characteristics of the wastes; and;

- The metal debris remaining after thermal treatment of the wastes is typically present in elemental states or as oxides that are insoluble or of limited solubility in water (see Table C-3), thus eliminating the potential for metallic compounds to migrate through the soil or into surface water or groundwater.

E-3 AIR ASSESSMENT

E-3a VOLUME AND CHARACTERISTICS OF THE WASTE

Refer to Section E-1a for a discussion of waste volume and characteristics.

E-3b REDUCTION OR PREVENTION OF EMISSIONS

There are no structures or control systems designed to prevent or reduce emissions of hazardous constituents to the air.

E-3c OPERATING CHARACTERISTICS

The OD Unit at Holloman AFB is currently operated on an intermittent basis for treatment of waste energetic items. Nearly all of the energetic materials are transformed into gaseous or particulate form. The time required for the detonation process consists of two components which include the following:

- waste placement and stacking (1 to 8 hours),
- detonation inspection (1 hour)

The emissions associated with the process are nearly instantaneous due to the nature of the treatment process. Total emissions and analysis of potential receptor exposures are presented for typical treatment cases in Section E-3f.

E-3d ATMOSPHERIC, METEOROLOGICAL, AND TOPOGRAPHIC CHARACTERISTICS

The 20,000 OD Unit at Holloman AFB is situated on flat terrain. There are no complex topographic features in the vicinity. The meteorologic conditions on-site are summarized in Table E-3. Additionally, wind roses for the last five years are presented in Attachment E-1.

E-3e EXISTING AIR QUALITY

Otero County, NM is identified as an attainment area for all National Ambient Air Quality Standards (NAAQS). Holloman AFB is in comliance with all applicable NAAQS. Holloman AFB is a major source under Titles III and V of the Clean Air Act Amendments, as well as a major source in terms of Prevention of Significant Deterioration (PSD) requirements. The Base has submitted all appropriate permit applications for these regulations, and is in compliance with all requirements. Table E-4 summarizes the state and federal NAAQS, PSD, Title III, and Title V levels.

E3-f ASSESSMENT OF AIR MIGRATION POTENTIAL

Holloman AFB, located in Alamagordo, New Mexico, treats various hazardous materials through open detonation at their 20,000-Pound OD unit. The 20,000-Pound OD Unit is located to the north-northeast of the high speed test track within the northern portion of Holloman AFB and is about 2600 feet (800 meters) from the nearest property location. The following modeling analysis assumes that the maximum annual detonation mass is 50,000 pounds net explosive weight (NEW) and the maximum single detonation mass is 20,000 pounds NEW. An air quality analysis was performed to determine the ambient impacts on nearby receptors due to the 20,000-Pound OD unit.

Since the open detonation activities are short-duration events, the air quality analysis conducted used the INPUFF model. This air dispersion model is available through the EPA's UNAMAP system. INPUFF is designed to estimate concentrations from semi-instantaneous point sources.

The 20,000-Pound OD unit emissions were estimated based on emission factors derived by the U.S. Army Armament, Munitions and Chemical Command *(Development of Methodology and Technology for Identifying and Quantifying Emission Products from Open Burning and Open Detonation Thermal Treatment Methods)*, and from EPA's *Compilation of Air Pollution Emission Factors* (AP-42). The U.S. Army tests were conducted during field tests conducted between 1988 and 1990 at the Dugway Proving Ground in Utah.

The air quality assessment presents in the following information:

- Windroses for the past 5 years (Attachment E-1);
- Description of the INPUFF model;
- Modeling methodology;
- Source parameters;
- Emission factors and rates; and,
- Dispersion modeling results.

The 20,000-Pound OD unit modeled impacts were compared to the New Mexico and the National Ambient Air Quality Standards (AAQS). Furthermore, Toxic Air Pollutants (TAPs) impacts were compared to the New Mexico Air Quality Control Regulations (AQCR) 702 limits, which are defined as 1/100 of the Occupational Exposure Limit (OEL).

Table E-4 displays the emission factors, AAQS, and the results of the INPUFF modeling for each pollutant. All pollutant impacts are within compliance of the air quality standards.

Table E-4
Air Quality Standards, Emission Factors and Modeled Impacts for the 20,000-Pound OD Unit

Compound	Averaging Period	Emission Factor (lb/lb)	AAQS or 1/100 OEL ($\mu g/m^3$)	Modeled Impact ($\mu g/m^3$)	Reference
CRITERIA POLLUTANTS					
Carbon Monoxide	1-Hour 8-Hour	0.472	12,480 8,285	150 18.7	2
Lead	3-month	6.0E-04	1.5	2.21E-04	2
Nitrogen Dioxide	24-Hour Annual	0.0595	156 78.0	0.787 0.00539	2
PM_{10}	24-Hour Annual	0.760	150 50	10.1 0.0689	3
Sulfur Dioxide	3-Hour 24-Hour Annual	0.00800	1,300 218 43.5	0.847 0.106 7.25E-04	2
HAZARDOUS AIR POLLUTANTS					
1,3-Butadiene	8-Hour	4.17E-05	200	1.66E-03	1
1,4-Dichlorobenzene	8-Hour	3.15E-07	3000	1.25E-05	1
2,4-Dinitrotoluene	8-Hour	8.40E-06	15	3.33E-04	1
4-Nitrophenol	8-Hour	2.59E-06	---	1.03E-04	1
Acetophenone	8-Hour	1.50E-05	---	5.95E-04	1
Antimony	8-Hour	1.06E-06	5	4.21E-05	1
Arsenic	8-Hour	2.23E-05	---	8.85E-04	1
Benzene	8-Hour	1.10E-04	---	4.37E-03	1
Biphenyl	8-Hour	5.20E-08	15	2.06E-06	1
Bis(2-ethylhexyl) phthalate	8-Hour	3.61E-06	---	1.43E-04	1
Cadmium	8-Hour	2.86E-06	0.5	1.14E-04	1
Carbon Tetrachloride	8-Hour	6.30E-06	300	2.50E-04	1
Chromium	8-Hour	3.52E-06	5	1.40E-04	1
Dibenzofuran	8-Hour	1.32E-06	---	5.24E-05	1
Hydrogen Cyanide	8-Hour	0.0160	100	0.635	2

Compound	Averaging Period	Emission Factor (lb/lb)	AAQS or 1/100 OEL (µg/m^3)	Modeled Impact (µg/m^3)	Reference
Mercury	8-Hour	1.64E-07	---	6.51E-06	1
Naphthalene	8-Hour	1.50E-04	500	5.95E-03	1
Nickel	8-Hour	2.54E-06	10	1.01E-04	1
Phenol	8-Hour	2.52E-05	190	1.00E-03	1
Vinyl Chloride	8-Hour	1.23E-06	---	4.88E-05	1

1 Development of Methodology and Technology for Identifying and Quantifying Emission Products from Open Burning and Open Detonation Thermal Treatment Methods, Bang Box Test Series. Headquarters US Army Armaments, Munitions, and Chemical Command. Volume I, 1992.

2 US Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 1993.

3 Air Quality Modeling Report for the Kirtland Air Force Base Open Burning/Open Detonation Facility, Radian, Sept, 1995.

E3-f(1) DESCRIPTION OF THE INPUFF MODEL

INPUFF is a Gaussian-integrated puff model used to model either semi-instantaneous releases or the more typical continuous plume emitted from a stack, over a spatially and temporally variable wind speed. The puff model is usually employed when the release interval of the plume cloud is less than the travel time of the cloud to the receptor. The algorithm assumes a vertically uniform wind direction field and no chemical reactions. Dispersion is assumed in the z, y, and downwind (x) directions. Puffs are assumed to be circular with the highest concentration in the center of the plume. The release puff is then transported by wind, growing in size as it entrains ambient air. The mass of the gas in the cloud does not change as the cloud moves downwind, but its concentration decreases as more ambient air is entrained.

The meteorological inputs to the model include wind speed, wind direction, ambient temperature, mixing height, stability class and anemometer height. Source inputs to the model include location, emission rate, release height, exhaust temperature, stack gas volume, initial dispersion parameters, and gravitational and deposition settling velocities.

The average puff concentration is a function of wind speed and the distance of the

receptor from the initial puff release location. At long downwind distances and high wind speeds, the average concentration will be significantly lower than the peak instantaneous concentrations; this occurs because the puff has become so dilute. At shorter distances and lower wind speeds, the peak instantaneous concentrations will be about the same as the average concentration.

INPUFF (Version 2.3), an EPA approved model, was used in the 20,000-Pound OD unit modeling exercise.

The following model options were used in INPUFF:

- The Pasquill-Gifford (P-G) model option was used to determine downwind dispersion. The P-G dispersion scheme is a function of downwind distance and stability class.

- The buoyancy-induced dispersion option was used. Plume rise was calculated considering both momentum and buoyancy.

- The stack tip downwind option was used. A height increment is deducted from the physical stack height before momentum or buoyancy rise is determined. This option affects sources with small ratios of exit velocity to wind speed, similar to the open detonation.

- The puff combination option was used. Puffs are combined when their centers are within one lateral standard deviation of each other.

- The settling and dry deposition velocities were set to zero. Using a zero settling velocity gives a conservative estimate of concentrations, since particulate settling is not taken into account.

E3-f(2) METEOROLOGICAL AND SOURCE PARAMETERS

The following meteorological inputs were used (based on conditions in El Paso, Texas, which is located 75 miles south-southwest of Holloman AFB). Table E-3 displays significant meteorological data.

- A mixing height of 2,610 meters, the average mixing height at El Paso, was used.

- A very large value for the transition to long travel time dispersion was selected

(25,000 meters). If the puff had attained a horizontal dimension of 25,000 meters, the model would have switched to the long travel time dispersion when puff growth rate is proportional to the square root of time. The 25,000 meters value was conservatively chosen so that the long time code algorithm would not be executed.

- A wind direction was chosen so that all target receptors were directly downwind, giving a conservative value for downwind concentrations.

- Stability classes, A through D (1 through 4) were used in the modeling exercise. The E and F (5 and 6) stability classes were not used since all 20,000-Pound OD unit activities take place only during daylight hours. E and F rarely occur during the day.

- The climate for El Paso, Texas is characterized by an annual minimum daily temperature of 49°F, an annual daily maximum of 78°F, and an annual average of 63.0°F. The annual mean wind speed is 8.8 miles per hour.

All above meteorological data was acquired from the *Comparative Climatic Data for the United States through 1992*.

Ambient concentrations from the 20,000-Pound OD unit were calculated for a number of receptors located beyond the open detonation area. The first receptor was placed at the nearest property line location, 800 meters downwind. Subsequent receptors were placed at 100 meter intervals to 1 kilometer from the 20,000-Pound OD Unit, at 1 km intervals to 10 km beyond the unit, and 5 km intervals to 25 km beyond the unit. The nearby terrain is flat, with hills and mountains about 6 km to the east.

A unit emission rate of 1,000 g/sec was used in the modeling analysis. The modeled concentrations resulting from the unit emission were scaled to reflect actual emission rates. An emission release height of 1.0 meter was chosen. This modeling analysis assumed that the open detonation is conducted in a circular area with a diameter of 30 feet (9.14 meters). A release flowrate was calculated based on the stoichiometry and the duration of the detonation (300 seconds) event. Initial plume dispersion parameters (sigma z and sigma y) were conservatively set equal to zero. This is a conservative approach, which yields higher air contaminant concentrations at the receptors.

The release temperature was calculated using an adiabatic flame temperature. Tests show that open detonation activities are extremely efficient processes when carbon is converted to CO_2. For surface detonations, all but six percent of the carbon in TNT is converted to CO_2 and most of the remaining is CO. The release temperature was based on the conversion of carbon to CO_2 in the presence of 50 percent excess air. Some quenching effort due to soil may take place during OD activities, but the magnitude of this effect is not clear. A flame temperature of 2,800°F was selected for the 20,000-Pound OD unit modeling exercise. This flame temperature correlates well with combustion temperatures of between 1,800°F and 3,000°F reported in other OD studies (El Dorado Engineering, 1991).

For the OD activities, which are instantaneous, burn times are not relevant. However, INPUFF requires the input rate variable inputs such as flowrate and velocity. Therefore, a "burn time" of five minutes was chosen for 20,000-Pound OD unit activities. The blast is instantaneous; however, the detonation burn may take a few minutes to subside.

The volumetric flow rate is based on stoichiometry considering no excess air. This is conservative since the smaller the volumetric flowrate, the higher the concentration at the receptors. The mass of OD unit materials is limited to 20,000 pounds per event. Considering the OD unit material to consist mainly of carbon, the volumetric flowrate was calculated as follows:

$$C + O_2 \rightarrow CO_2$$

$$12\ \textit{lbs}\ C + 32\ \textit{lbs}\ O_2 \rightarrow 44\ \textit{lbs}\ CO_2$$

$$\frac{20{,}000\ \textit{lbs}\ C \rightarrow 20{,}000 \times 44\ \textit{lbs}\ CO_2}{12\ \textit{lbs}\ C}$$

$$= 73{,}333\ \textit{lbs of}\ CO_2$$

$$= 1{,}667\ \textit{lb moles}\ CO_2$$

1 lb mole of an ideal gas occupies 2,379 ft^3 @ 14.7 psi and 2,800°C

Therefore, 1,667 lbs moles of CO_2 would occupy:

	=	1,667 x 2,379 ft^3
	=	3,965,793 ft^3
Volumetric flow rate	=	3,965,793 ft^3/300 sec
	=	13,219 ft^3/sec
	=	374 m^3/sec

The release velocities were calculated from the volumetric flow rate and the release diameter:

Release velocity	=	74 m^3/sec / 65.6 m^2
	=	5.70 m/sec

E3-f(3) EMISSION FACTORS AND RATES

The emission calculations presented in this section are based on emission factors developed as a result of two types of emission tests conducted in New Mexico and Utah by the Headquarters, U.S. Army Armament, Munitions, and Chemicals Command from 1988 through 1990. The first series of tests involved trinitrotoluene (TNT) detonations and propellant burns characterized in a Bang Box (BB) chamber during December 1988 and January 1989.

The BB test facility was used to determine emission factors for volatile organic (VOCs), semivolatiles, nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), sulfur dioxide (SO_2), ozone, organic particulate, metals, ammonia (NH_3), hydrogen cyanide (HCN), and hydrogen chloride (HCl). The materials tested inside the Bang Box were TNT, a double-base propellant containing primarily nitrocellulose, and nitroglycerin with added ethyl cellulose and a composite propellant containing ammonium per chlorate.

The U.S. Army's second series of field tests occurred in 1989 and 1990. The test included the open burning of M30 (triple-base propellant), BM6 (M6 propellant), BMl (Ml propellant), and BMR (propellant manufacturing residue). Open detonation included the detonation of TNT, CMB (Composition B), EXD (explosives D), and RDX (cyclotrimethylene trinitramine). The type of OD materials detonated during these tests were either the same or similar to the type of materials detonated. Open detonation was conducted by either suspending the explosive above ground or by surface detonation. Combination products were analyzed from: 1) soil samples, 2) blast material deposited on pans placed at various distances from the source, and 3) samplers mounted on aircraft. For the emissions factors used in this application, the worst-case (highest) factor was selected for each compound from all BB tests, field tests, and the EPA's AP-42 document. Table E-1 displays the emission factors which were used for this analysis.

Particulate concentrations during the field tests were determined by taking soil samples and expressing the concentrations as grams per gram of soil. No emission factors relating particulate matter debris to the quantity of material detonated were available. During surface detonation, the component of the blast wave is propagated

parallel to the ground stirring up a dust cloud into the atmosphere and extending radially out from the center. Particulate emissions vary due to influences of soil moisture and composition. A large portion of the displaced ejected soil (ejecta) are redeposited in the crater or within a few meters of the crater.

The following discussion concerns the estimation of particulate emissions due to the ejecta. The typical depression produced from a 20,000 pounds NEW detonation was estimated to be a conical depression, 5 feet deep and 30 feet wide. This represents a volume of 1178 cubic feet (33.4 cubic meters). Assuming a soil density (for desert sand) of 1,330 kilograms per cubic meter, each detonation results in 44,370 kilograms of soil removed. The majority of this soil deposits on the ground near the detonation site (within a 150 foot radius). For the purpose of estimating PM_{10} emissions, it has been assumed that 1% of the volume of the crater is emitted into the atmosphere as particulate. This results in a maximum PM emission rate of 444 kilograms per event (0.05 lb/lb charge). A PM emission factor of 0.71 lb/lb of charge was observed in RDX surface detonation by the Air Force in 1994. Combining of the PM emissions from the combustion and the indirect activities (ejecta) yields a maximum total PM emission factor of 0.76 lb/lb charge. This is a very conservative value. All particles are considered to be PM_{10} particles. This emission factor was used to calculate particulate emissions for the 20,000-Pound OD unit.

E3-f(4) DISPERSION MODELING RESULTS

The INPUFF ambient impacts were simulated for the 8-hour averaging period. Since the release periods for 20,000-Pound OD Unit events are short compared to the averaging periods, the 24-hour averaging period concentrations were determined to be 1/3 the 8-hour concentrations. Similarly, the 1-hour averaging concentrations were determined by multiplying the 8-hour concentrations by eight. Other averaging periods were calculated in the same manner. The modeling was completed for stability classes A through D since the 20,000-Pound OD Unit activities only take place during daylight hours and stability classes E and F normally occur during nighttime. Wind speeds between 1 m/s (calm winds) and 20 m/s were used. The modeled results show that the ambient concentrations for criteria pollutants are below all the ambient air quality standards (See Table E-1). Table E-2 shows the maximum 8-hour unit impacts (based on

1,000 g/s) at each receptor. The unit impacts should be multiplied by the emission factor and adjusted to the particular averaging period for comparison to the ambient air quality standards. The results show that most receptors are impacted greatest during low wind speed and very stable atmospheric conditions.

Pollutant: CO Burn time: 300 seconds

Maximum emission factor: 0.472 lbs/lb of charge

Emission rate of CO = $\frac{0.472 \text{ lb}}{\text{lb of charge}} \times 20{,}000 \text{ lbs of charge}$

= 9,440 lbs of CO in 300 seconds (4,280,100 g)

= 14,270 g/s

Ambient concentration for an emission rate of 1,000 g/sec:

8-hour averaging period concentration = 1.31 $\mu g/m^3$

1-hour averaging period concentration = 10.5 $\mu g/m^3$

24-hour averaging period concentration = 0.434 $\mu g/m^3$

Annual averaging period concentration = 0.003 $\mu g/m^3$

Maximum 1-hour off-site CO concentration due to open detonation of 20,000 lbs:

$$= \frac{14{,}270 \text{ g/sec}}{1{,}000 \text{ g/sec}} \times 10.5\ \mu g/m^3$$

$$= 155\ \mu g/m^3$$

Maximum 8-hour off-site CO concentration due to open detonation of 20,000 lbs:

$$= \frac{14{,}270 \text{ g/sec}}{1{,}000 \text{ g/sec}} \times 1.31\ \mu g/m^3$$

$$= 18.7\ \mu g/m^3$$

Maximum NEW detonated per year = 50,000 lbs

Number of events required to burn 50,000 lbs at 20,000 lbs per event

$$= \frac{50{,}000 \text{ lbs/year}}{20{,}000 \text{ lbs/event}}$$

$$= 2.5 \text{ events per year}$$

Maximum annual off-site concentration of CO:

$$= \frac{14{,}270 \text{ g/sec} \times 0.437\ \mu g/m^3 \times 2.5 \text{ events/year} \times 1 \text{ year}}{1{,}000 \text{ g/sec} \times 365 \text{ days}}$$

$$= 0.044\ \mu g/m^3$$

The air quality assessment of 20,000-Pound OD Unit activities consisted of a description of the INPUFF model, modeling methodology, source parameters, emission factors and rates and the dispersion modeling results. The dispersion modeling results show that the 20,000-Pound OD Unit operations are within compliance with the AAQS for the criteria pollutants. Toxic air pollutant impacts are all below the 1/100 OEL limits in AQCR 702.

Table E-5
Maximum Modeled Unit Emission Concentrations[a]
from 20,000-Pound OD Unit Activities

Receptor Distance (km)	Wind Speed (m/s)	Stability Class	Maximum 8-Hour Concentration (µg/m³)
0.5	1.0	1	0.101
0.6	3.0	1	0.204
0.7	3.0	1	0.367
0.8	3.0	1	0.587
0.9	3.0	1	0.848
1.0	3.0	1	1.12

2.0	2.0	1	1.11
3.0	1.0	1	1.31
4.0	1.0	1	1.31
5.0	20.0	4	1.25
10.0	1.0	1	0.736
15.0	1.0	1	0.544
20.0	1.0	2	0.553
25.0	1.0	2	0.464

[a] Based on a unit emission rate of 1,000 g/s.

Attachment E-1
Wind Rose Data

SECTION D

PROCESS INFORMATION

D-1 CONTAINERS -- Not Applicable

D-2 TANKS -- Not Applicable

D-3 WASTE PILES -- Not Applicable

D-4 SURFACE IMPOUNDMENTS -- Not Applicable

D-5 INCINERATORS -- Not Applicable

D-6 LANDFILLS -- Not Applicable

D-7 LAND TREATMENT -- Not Applicable

D-8 MISCELLANEOUS UNITS

The 20,000-Pound OD Unit provides treatment to waste propellant items that are considered to be characteristically hazardous on the basis of reactivity. ~~The unit consists of a cleared circular area approximately 1600 feet in diameter that is encircled by and approximately 2 to 3 foot earthen berm. Within this cleared area, a pit that is approximately 20 to 30 feet in diameter is excavated to a depth of approximately 10 feet. The subject reactive wastes are placed in the pit, and RDX charges are attached.~~ The unit consists of a cleared area, approximately 400 feet in diameter, within which the explosive ordnance waste is placed on top of the ground. RDX (C-4) charges are strategically attached to the wastes and detonated. During treatment, the initial RDX detonation results in rupture of the propellant casing that allows detonation of the contents to occur. After the detonation, the EOD personnel inspect the surface contents to ensure that all reactive materials have been destroyed.

D-8a TYPE AND QUANTITY OF WASTE

Types of waste that have previously been treated in the 20,000-Pound OD Unit were identified in Section C-1. These wastes may be summarized as propellants that consist primarily of nitrocellulose and nitroglycerin.

RDX charges in the form of an explosive train are used to initiate detonation. The charge, primer, and detonator are not waste items when used in this fashion. The ~~total mass limit~~ net explosive weight (NEW) limit per treatment event is 20,000 pounds of explosive material plus the weight of the casings and detonation devices. Propellant devices typically contain a larger percentage of energetic material per total mass than do explosive items. The percentage of energetic material in propellant devices is estimated to range from 40 to 50% of the total mass. The remainder of the mass of these items is present as the casings or canister that holds the energetic material. ~~Thus, for any given treatment event, the total quantity of energetic material will be less than 8,000 to 10,000 pounds~~. The nature of the generating process (shelf-life exceedance, failure to exhaust during use, etc.) prohibits strict specification of the total mass of the energetic material present in the OD Unit for any discrete treatment event, although it is probable that the total energetic mass seldom exceeds 10,000 pounds. Thus, it is estimated that the total mass of energetic material annually treated in the 20,000-Pound OD Unit seldom exceeds 50,000 pounds NEW.

D-8b(1) LINER EXEMPTION

Recently promulgated 40 CFR 264.601 standards for miscellaneous units indicate that "permits, terms and provisions shall include those requirements of Subparts I through O" of Part 264 that are appropriate to the miscellaneous unit being permitted. Under RCRA standards, all land-based units, with the exception of land treatment, are required to provide liner systems in the design unless exempted from this requirement. A request for exemption from the application of any liner standards is submitted.

D-8b EXEMPTION BASED ON EXISTING PORTION

An exemption on the basis that the 20,000-Pound OD Unit is an existing portion of a land-disposed unit is not requested. The 20,000-Pound OD Unit does not provide

land disposal of hazardous waste, but is utilized for the purpose of treatment and renders the waste nonhazardous in nature.

D-8b(2) EXEMPTION BASED ON ALTERNATIVE DESIGN, LOCATION, AND OPERATING CHARACTERISTICS

An exemption from application of liner standards is requested on the basis of alternative design, location, and operating characteristics. The combined effect of these factors is to significantly reduce the potential for migration of any hazardous constituent from the unit.

D-8b(2)(a) ALTERNATIVE DESIGN

The design considerations that are pertinent to this request are:

(1) Installation of any liner system is impractical for the conditions that are experienced during thermal treatment.

(2) Thermal treatment renders the waste nonreactive and nonignitable. Posttreatment sampling and the management practices for residuals combine to ensure that hazardous wastes are not disposed of at the site. ~~in the trench.~~

The first design consideration that supports the request for exemption from application of liner standards results from the impracticality of liner placement in or near the treatment zones. Placement of any form of liner material directly beneath the waste is prohibited because it would be destroyed.

Theoretical calculations based upon estimated products of combustion indicate that temperatures in the treatment zone will range from 2100°C to 3200°C. Thus, any flexible membrane liner (FML) type material that was placed directly beneath the waste would be destroyed. Furthermore, concrete could not serve as a liner material because detonation during treatment would result in its fragmentation.

During detonation, fragmentation of the ordnance casings occurs as heat input to the item causes pressure to increase within the casings. Upon rupture, fragments of the

casing eject in all directions with great velocity. The impact of these fragments upon any liner material would destroy the containment integrity even if it is assumed that the liner could withstand the temperatures.

~~Placement of a liner at some depth below the treatment zone is not practical since the posttreatment crater sometimes extends to depths of approximately 30 or 40 feet. This consideration indicates the need for a separation between any possible liner and detonation zone that the value of the liner would be questionable.~~

Exemption from application of liner standards is supported on the basis that the 20,000-Pound OD Unit functions as a thermal treatment unit and does not provide for disposal of hazardous waste. Wastes that are input to the OD Unit are considered characteristically hazardous on the basis of reactivity. Posttreatment inspections of the residuals are designed to ensure that reactive fragments do not exist. Furthermore, annual sampling and analysis is performed to confirm that the residuals and underlying soils do not exhibit any of the characteristics of hazardous waste.

Conjunctive treatment nonordnance type waste (i.e., solvents) is prohibited by Technical Order (TO) 11A-1-42 and Holloman AFB Regulation 125-2. Thus, the only listed wasted placed for treatment is nitroglycerin (P081). The detonation train may contain lead azide, lead styphnate, or mercury fulminate in addition to the RDX charge, but these are not waste items. Mercury fulminate is rarely used because of its extreme instability. In these limited number of primers that may contain mercury fulminate, the total mass of this compound is less than 0.24 grams.

Posttreatment sampling of the residues is designed to confirm that the residuals are not ~~reactive~~ hazardous in nature. ~~The parameters for extraction procedure (EP) toxicity, NO_2-NO_3, and TKN are indicated in the posttreatment analytical protocols to confirm that the residual no longer exhibits the characteristics for which these wastes were listed. Residuals that exhibit the characteristic of EP toxicity or reactivity are removed from the unit prior to its posttreatment coverage with active soils.~~ Samples are analyzed to ensure that explosive residues are not present at unsafe levels in the soil. Additionally, samples are analyzed for a suite of inorganic constituents to ensure that they are not present at levels above those naturally occurring in the soils or at levels that

could pose a risk to those exposed to the site. The Sampling and Analysis Plan, Attachment C-1, provides detailed information on the analyses that will be performed.

~~Additionally, the sampling protocols are designed to ensure that additional hazardous constituents are not present in the residuals. The additional hazardous constituents that may be present include dinitrotoluene, tetracene, and antimony based compounds.~~

~~Although some potential exists for dinitrotoluene to enter the trench for treatment, this constituent does not meet the listing criteria for discarded commercial products or products in which the listed constituent is the sole active ingredient. Tetrecene (a nitrosamine-based compound) and antimony sulfide meet only the not otherwise specified (NOS) criteria for hazardous constituents and are not specifically listed.~~

Under the conditions of the thermal treatment, the organic constituents are oxidized to CO, CO_2, N_2, NO_x, H_2O, and are not expected to remain in the residuals. The posttreatment protocols are designed to confirm the destruction of these constituents and ensure that these compounds are not present at the time of subunit closure.

D-8b(2)(b) LOCATION

The location considerations pertinent to the request for exemption from application of liner standards are:

1. The 20,000-Pound OD Unit is located in an area with limited precipitation.
2. The net aquifer recharge rate in the area is negative.
3. The uppermost aquifer is of insufficient quality for use as a potable water supply.

The Tularosa Basin climate is arid with exceptionally low precipitation and low relative humidity. Over a period of 44 years, the average annual precipitation was 7.9 ~~8.3~~ inches. The peak monthly precipitation during this time was 4.5 inches and the maximum 24-hour event for the 44-year period was 2.1 inches.

The mean annual lake evaporation, commonly used to estimate evapotranspiration and aquifer recharge is 67 inches per year. Thus, the annual net precipitation is -59 inches per year and recharge rates to the uppermost aquifer are limited. Additionally, the potential contribution of runon/runoff to contaminant transport is limited because the Tularosa Basin is closed with respect to surface water flows. The limited surface water drainage that occurs within the base is controlled by intermittent streams and arroyos. The 20,000-Pound OD Unit, located in the more elevated portions of the base, is approximately 50 to 100 feet above the main base. No intermittent streams are nearby. Runon that might contribute to contaminant transport is limited due to the low precipitation rate. ~~excluded by an earthen berm of approximately 2 to 3 feet in height.~~ Thus, the potential for contaminant transport by surface water is limited.

~~The depth to the water table is reported as <10 feet in the southern portions of the base. It is considered probable that the water table is at >10 foot depths below the 20,000-Pound OD Unit because the area's surface elevation ranges from approximately 50 to 100 feet above the areas reported to have water table depths of 10 feet. This conclusion is supported by historical evidence that water has never been encountered during treatment.~~ The depth to the water table is approximately 30 feet at the 20,000-Pound OD Unit. It should be noted that the underlying aquifer is naturally high in sulfate and chloride salts (>5,000 ~~10,000~~ ppm). These concentrations render the aquifer useless as a potable water supply. Thus, any unlikely contaminant transport to groundwaters from the 20,000-Pound OD Unit would not result in impacts to drinking water supplies. A future section further describes the hydrogeological factors pertinent to the 20,000-Pound OD Unit and further addresses the potential for contaminant transport.

D-8b(2)(c) OPERATING CHARACTERISTICS

The operating characteristics pertinent to the request for exemption from application of liner standards are:

1. The 20,000-Pound OD Unit provides thermal treatment to wastes that are hazardous primarily due to reactivity. Treatment of these wastes yields nonhazardous residues; thus, no disposal of hazardous waste is performed.

2. Treatment events are not conducted during precipitation events or if such an event is imminent.

3. No free liquids are treated in the unit. Accumulation of free liquids within the residuals contained in the depressions caused by the detonation events ~~trench~~ is prevented by OD Unit operation ~~the pit operation~~.

4. Runon is unlikely to enter the ~~pit~~ OD Unit because of the limited annual precipitation.

5. Residuals are nonhazardous in nature. Organic constituents are converted to gaseous products during treatment. ~~EP metal~~ Inorganic constituents are present in either elemental states or as oxides that are of limited solubility.

6. Inspections and annual sampling are designed to identify the presence of any unreacted hazardous waste or hazardous constituents. Treatment is repeated if unreacted wastes are found in the detonation depression ~~trench~~. Results from the sampling and analysis are reviewed to ensure that there are no residuals that could potentially pose a risk to anyone exposed to the site. ~~Residuals are removed if sampling reveals EP toxicity or unacceptable concentrations of hazardous constituents.~~

Section D-8b(1) discussed the operation of the 20,000-Pound OD Unit as a thermal treatment unit and indicated that hazardous waste is not disposed of in the OD Unit. The TO (TO 11A-1-42) Holloman AFB regulations govern operations at the 20,000-Pound OD Unit. Thermal treatment operations are conducted only during weather conditions that are identified as excellent or fair in ~~Table 1-1 of~~ the technical order. ~~indicated as Exhibit D-1.~~ In general, these conditions allow treatment events only at specified daytime conditions of:

(1) wind speed 3-15 miles per hour,
(2) temperature >55°F, and
(3) clear or partly cloudy skies.

Thermal treatment is not performed during precipitation events. If partly cloudy skies exist, the base meteorological division is contacted to ensure that precipitation is not imminent. The wastes that are treated in the unit contain no free liquids.

The organic constituents of the initial charge are converted to gases during treatment. The distribution of expected gas products from treatment is indicated in Section E-3. During treatment, the oxidant portion of the C-4 detonators (which is the primary potential source of inorganic constituents ~~EP metals~~) is reduced to the elemental form or the oxide as indicated in a previous section. Barium oxide from the nitrate in the priming charge is soluble to the extent of approximately 3.5%. Lead oxide (possibly from primers or detonators) is soluble to the limited extent of approximately 20 mg/L. Antimony and mercury oxides exhibit solubility similar to the oxide of lead. In general, detonators that are the primary potential source for lead or mercury are less than 1.0 gram in mass.

The final operating characteristics consideration is management of residuals to ensure that hazardous wastes are not closed in place at the time of placing the soil cover. Residuals management involves inspections to ensure that all items ~~placed in the pit~~ are destroyed and review of the annual sampling results to ensure that no residuals remain that could potentially pose a risk to anyone exposed to the site, ~~annual sampling and removal of residuals that are characteristically hazardous~~. Inspection requirements and residuals management are further defined in Sections D-8d and F. Posttreatment sampling was discussed in Section C.

D-8b(3) GROUNDWATER MONITORING EXEMPTION

A request for exemption from application of groundwater monitoring standards is submitted as Attachment D-1. ~~This request is based upon consideration of the factors listed below.~~

~~**(1)** The 20,000 OD Unit operates as a thermal treatment unit and the activities conducted at this unit are not considered disposal of hazardous waste. Residuals are inspected and sampled to confirm the effectiveness of treatment. Sampling is also~~

~~designed to ensure that subsoils are not contaminated. Residuals that exhibit hazardous waste characteristics or contaminated soils are removed from the unit.~~

~~**(2)** The groundwater monitoring requirements are defined as waste piles and treatment units, surface impoundments, and landfills that receive hazardous waste after July 26, 1982. No specific groundwater monitoring requirements are applied to miscellaneous units regulated under 40 CFR 264, Subpart X. Sampling protocols of Section C are intended to ensure that operation as a regulated unit does not occur.~~

~~**(3)** The design considerations and operating practices relative to this unit, discussed in the preceding section, indicate that the potential for migrations of constituents is limited. In particular, the factors that limit the potential for migration are:~~

- ~~no free liquids are treated;~~
- ~~construction of the drainage ditch in the trench prevents contact with runon and limited precipitation that might occur;~~
- ~~the mobility of the potential constituents in the residuals is limited. Organics are translated to gas products as discussed in Section E-3. Of the oxides from primary or detonating charges, (P) or (SbO) have solubilities of less than 20 mg/L and only BaO has appreciable solubility.~~

~~**(4)** As described in Section E-1, the location characteristics of the unit indicate the potential for migration is very limited.~~

D-8c DESIGN AND CONSTRUCTION

~~The 20,000lb ED Area consist of any approximately 1680 foot diameter explosive zone area in which approximately 40 t0 60 feet diameter by 10 feet deep pits are alternately developed. Access to this area is provided by a single paved road that terminates at the end the Test Track. A dirt road of approximately one quarter mile is used for access from the paved road to the pit. The unit is used for thermal destruction of~~

~~wasted propellant devices. A total mass limit of 20,000 pounds of waste propellant (including inert casings, etc.) is established for the unit.~~

The 20,000-Pound OD Unit consists of a cleared area, approximately 400 feet in diameter, within which waste propellant devices are placed on top of the ground and subsequently detonated. Access to the area is provided by a single paved road that terminates at the end of the Test Track. A dirt road, approximately one-quarter mile long, is used for access from the paved road to the OD Unit.

The OD Unit has an established limit of 20,000 pounds NEW of waste per detonation . A unit drawing, showing the dimensions and layout of the area, is provided in Figure B-5.

D-8c(1) SPECIFICATIONS

~~Treatment of waste propellant is facilitated by excavation of an approximately 40 to 60 foot diameter pit within the cleared area. The pit is opened, used for thermal treatment, and covered with original soil. Subsequent treatment events are performed by development of excavation in the same location in the same fashion. To limit treatment amount in a single pit, and therefore enhance safety, two pits may be operable at one time. If two pits are used the combined mass of the waste will not exceed 20,000lb.~~

~~Construction of the thermal treatment pit is initiated by submission of a work order from, the EOD office to Holloman AFB Civil Engineering. This work order specifies the general dimensions of the pit, its location, and anticipated date of use. Actual excavation is performed by civil engineering personnel accompanied by EOD specialists. During pit excavation operations, no energetic items are located in the 20,000lb ED Area. Pit excavations are mad with standard earth-moving equipment (backhoe) operated by personnel trained and certified in its use. Similar considerations apply to backfilling operations after treatment events~~

~~The dimensions of either of the initial excavations is approximately 40 to 60 feet diameter by a depth of approximately 10 to 12 feet. The excavation is developed with sufficient sidewall slope to ensure stability. Although these gypsum sands are~~

~~sufficiently concretious in nature to allow sidewalls to be constructed at almost 90° general safety standards dictate sidewall slopes of approximately 2:1 (60°). During treatment, the detonation force widens the trench to a diameter of approximately 70 to 90 feet and a depth of approximately 30 to 40 feet.~~

~~During excavation, soil removed from the trench zone is placed away from the pit. The soil pile is separate from the excavation in order to prevent loose material from reentering the excavation and to prevent any runoff from the soil pile from entering the trench during its active life. During development of the excavation, the trench bottom is lightly compacted to provide suitable foundation for operations.~~

~~Treatment is performed in two designate pit locations, residuals are inspected and sampling is performed annually. Upon return of analytical results that indicate a lack of contamination, the pit is continued to be used. The interim cover is intended to further reduce the limited potential for migration of waste or constituents during periods between treatment events. Treatments are restricted during the time between sampling and analytical results. Upon receipt of verification that contamination does not exist, the subunit is cleared for treatments. Residuals management is further addressed in Section D-8d.~~

Treatment of waste propellant is accomplished by placing the waste on top of the ground within the cleared OD zone. Occasionally, shallow holes are dug in which to place the waste prior to detonation. This is performed in order to control the detonation pattern.

The force of the explosion frequently creates depressions in the ground. These depressions are inspected to ensure that the waste has been completely destroyed and to collect ejected residuals. After every detonation, a bulldozer smoothes out the site, filling in any depression left by the the detonation. The bulldozer is operated by personnel trained and certified in its use.

A unit drawing of the OD Unit is shown in Figure B-5. This drawing shows the dimensions of the OD Unit to scale.

D-8c(2) PROTECTION FROM PRECIPITATION

Protection from precipitation is provided to waste prior to and during treatment events by operating constraints that prohibit thermal treatment during precipitation events. Thermal treatment is also prohibited if such events are imminent. After completion of the treatment event, residuals that remain in the trench are protected from precipitation by the arid climate and backfill procedures discussed earlier.

D-8c(3) RUNON CONTROLS

Several natural factors contribute to a limited potential for runon to enter the OD Unit during the posttreatment period or prior to use of a recently opened unit. These factors include the limited precipitation received in the area, the moderate soil permeability that aids surface water infiltration, the limited relief present in the OD Unit, the OD Unit elevation relative to the surrounding area, and the high evaporative flux present in the region. ~~Although these factors severely restrict the potential for runon entering a subunit prior to use or after a thermal treatment event, several safety factors have been incorporated into the 20,000lb ED Area design and operation. The entire area is surrounded by an approximately 2 t0 3 foot high earthen berm that restricts entry of runon from adjacent areas of higher elevation. Soils from the excavation are separated from the pit opening to prevent runoff from the pile from entering the trench prior to treatment events. Finally, if precipitation occurs during the interim between trench excavation and precipitation occurs during the interim between trench excavation and treatment, the pit is not used until any standing liquids have dissipated.~~

D-8c(4) WIND DISPERSAL CONTROLS

The average annual wind speed in the region is approximately 5.7 miles per hour and the maximum monthly average wind speed is approximately 7 miles per hour. These values indicate limited potential for wind-based dispersion of treatment residuals. The~~residuals. For these wind speed values, the fact that the~~ residuals are located ~~from approximately 30 to 40 feet~~ below the surface as a result of the depressions created by the detonations. This fact, in combination with the wind speed values, will prove sufficient to control wind dispersal. The maximum wind speed value for the 44-year period ending

in August 1986 was approximately 80 miles per hour. If gale-force winds or wind speeds in excess of 15 miles per hour appear imminent, treatment will be postponed (see Section D-8d(1). Wind roses for the previous five years are shown in Attachment E-1.

D-8c(5) SUBSURFACE DATA/SLOPE STABILITY

Subsurface data relevant to contaminant transport in the unsaturated or saturated zones is provided in Section E-1. Four soil horizons ~~are~~ may be traversed ~~in the pit~~ by the depression depths, with the upper approximately 1 foot of soils being predominantly sands that are slightly sticky and nonplastic in nature. Below the 1-foot depth, the soils consist of gypsum that demonstrates transition from non-sticky nonplastic, and moist soil (approximately 20 inches) to gypsum soils that are slightly plastic, slightly sticky, hard, and somewhat friable. Geotechnical data, such as Atterberg limits, unconfined compression, direct shear strength or triaxial compression are not available~~. Therefore, to ensure slope stability of trench sidewalls, an approximate 2:1 slope is used for construction of the trench.~~

D-8c(6) SETTLEMENT POTENTIAL/LOAD-BEARING CAPACITY

~~The subunits are marked to designate their location after backfilling.~~ Waste transport vehicles do not traverse the surface of the backfilled OD Unit depressions, ~~trenches,~~ and the capacity for this type of vehicle is not required. The only equipment that traverses the unit surface is earth-moving equipment required for excavation. The load-bearing capacity of the backfilled ~~subunit~~ depressions is essentially equivalent to that of the unconsolidated materials present in the other undeveloped portion of the base. This capacity is sufficient to support light earth-moving equipment.

Limited subsidence occurs in the subunits because the void volume is relatively unaffected by treatment operations. After treatment, the cover and backfill consist largely of the ~~initially removed~~ soil displaced by the force of the detonation. The ash residues comprise only a limited portion of the fill. However, to retard wind erosion, reduce infiltration, and limit subsidence, the top layer in the cover will consist of mixed soils mounded slightly above the surface and compacted by five blade passes. Settlement

of such a cover is not expected to occur, but any limited subsidence will be replaced by natural action of wind-borne soil motion.

D-8c(7) RUNOFF CONTROLS

The ~~depressed nature of the pit excavation indicates that the~~ potential for runoff contaminated with residuals from the unit is essentially nonexistent. Residuals from the ~~trench~~ depressions are not brought to surface level at any time during the operation except for removal and disposal as hazardous waste (if required). The natural factors (limited relief, moderate soil permeability, low precipitation) that contribute to the limited potential for runon entering the unit also limit runoff from the clear zone. Therefore, no runoff controls are applied at the unit.

D-8c(8) DISTANCE REQUIREMENT

Interim status standards for thermal treatment units that provide detonation of waste explosives and propellant mixtures specify certain minimum distance requirements. These distances are based upon actual poundage of waste explosives present in the unit. Although the actual mass of energetic material present in the 20,000-Pound OD Unit operations is unknown, it is generally expected to be less than 10,000 pounds. For this mass of energetics, the required distance to buildings or adjacent property is 1730 feet (530 m). The clear zone boundary (no unauthorized entry, structures, etc.) is specified as 1680 feet from the 20,000-Pound OD Unit. The nearest building is located approximately 4,000 ~~1750~~ feet from the 20,000-Pound OD Unit.

D-8d TREATMENT PROCESS

The 20,000-Pound OD Unit provides thermal treatment to waste propellant devices identified as hazardous waste due to ~~ignitability or~~ reactivity. Certain constituents that may be present in these wastes could potentially pose a risk to those exposed to them. In order to render the wastes nonreactive and eliminate this risk, they are thermally treated. Once the wastes have been successfully treated, they are no longer considered hazardous. ~~are considered EP toxic or Appendix VIII hazardous constituents. Thermal treatment is facilitated by excavation of a pit that is used for a single detonation~~

~~limited to a total mass of 20,000 pounds.~~ Thermal treatment is accomplished by placing the waste within the cleared OD area and detonating it.

D-8d(1) PROCESS DESCRIPTION/OPERATING PRACTICES

Operational procedures at the 20,000-Pound OD Unit are governed by TO 11A-1-42 and Holloman AFB Regulation 136-2. These orders specify certain atmospheric conditions for treatment operations. In summary, these conditions are:

- temperature: general (>55°F); winter (not specified);
- wind speed: general (4 to 15 miles per hour); winter (7 to 15 miles per hour;
- precipitation: no treatments allowed;
- cloud cover: none or limited; and
- time: 0800 to 1800 hours.

The climatic conditions at Holloman AFB generally allow detonation to be conducted under conditions specified as “excellent” in TO 11A-1-42.

Personnel who perform operations in the 20,000-Pound OD Unit are specifically EOD-trained staff members. The total number of EOD personnel is limited to those required to perform the operation. A minimum of two personnel, one of which is an EOD supervisor, are required for all operations. These personnel are provided both initial training at the Indian Head, MD, school for ordnance and also receive annual reviews concerning ordnance items and RCRA requirements. Section H outlines required training. During all operations, the EOD supervisor operates as the range manager and controls initiation of the thermal treatment. Prior to initiation of the treatment event, all other EOD personnel are required to move and take cover south of the 20,000-Pound OD Unit outside the danger area.

Several efforts are performed prior to the thermal treatment event. All waste energetic items destined for treatment are inspected, logged, and accounted for prior to removal from stock or other designation as waste. It should be noted that these items

become waste primarily through shelf-life exceedance or inequalities noted during inspections of serviceable items. A complete inventory of items to be treated is compiled on the advance disposal request which requires HQ approval before treatment can proceed. Additionally, an inventory of items to be treated is recorded on the EOD Report (~~AFTO 358~~AF Form 3579). Prior to the scheduled treatment event, the EOD supervisor notifies the following base agencies:

- meteorological service (for imminent weather conditions);
- munitions control;
- base medical service;
- security police;
- base operations;
- ~~base fire chief (the IOSC if emergency occurs),~~
- the on-site coordinator; and
- base environmental coordinator.

The waste energetic items are transported in accordance with TO 11A-1-60 and other relevant orders. Prior to transport, the EOD supervisor briefs all members of the team on hazards associated with specific items, pertinent technical data, technical orders, specified treatment procedures, safety precautions, and transport procedures. Upon arrival at the unit, all waste energetic items are inspected and accounted for by comparison with the previously prepared inventory. During transport and operations, all nearby roads are cleared, posted, and maintained free of traffic.

To limit the potential for incidental detonations, all removal primer and detonating items are removed from the waste energetic items. No attempt is made to remove these items if they are integral parts of the device.

The actual treatment is ~~facilitated~~ accomplished by placement of the waste items ~~in the excavation~~ on top of the ground within the OD Unit and attachment of C-4 (RDX) donor charges to the waste item. An “explosive train” is constructed and detonation is initiated from the ~~bunker located in the clear zone~~ designated clear zone. The donor device consists of a series of components that are referred to as an explosive train once the individual devices are placed in combination. An explosive train consists of a primer,

an initial detonating agent, and a high explosive. Explosive train detonation is achieved by step-wise detonation of the ~~proceeding~~ components.

Primers compose an extremely small portion of total explosive train and are present in the device in quantities of 0.04 to 0.2 grams of energetic material.

Primary compositions are mixtures of finely-divided powders of various salts. An oxidant fuel and explosive are combined in the primary composition. Typical oxidants are barium nitrate and potassium chlorate. Fuels in the priming mixture are present in an amount equal to the oxidant (approximately 30%) and are one or more of the following compounds: lead thiocyanate, antimony sulfide, or calcium silicide. The explosive charge constitutes from 5 to 30% of mixture and is highly explosive in nature. Common explosive used in primers are lead azide, lead styphnate, and diazodinitrophenol (DDNP). If the explosive train operates without the use of the initial detonating charge, the explosive in the primer will consist of trinitrotoluene or pentaerythrite tetranitrate (PETN). The remainder of the primer composition consists of inert binders (gum arabic, wax, etc.).

The initial detonating agent for munitions or ordnance consists of a small charge of compressed high explosive. These agents are compounded to have stability to shock or heat that is intermediate between the very sensitive primer and the less sensitive high explosive charge. This charge consists of relatively pure (<99%) explosive similar to that used in the primer composition. The compounds typically utilized as the initial detonating agent include lead azide, lead styphnate, DDNP and tetracene. The total mass of the initial detonating charge is also small and usually consists of less than 100 grams of the agent.

High explosives may be segregated into four classes that are defined as single-compound explosives, binary explosives, plastic explosives, and dynamites. All four categories of explosives are based upon a limited group of energetic materials that are either compounded together (binary explosives) or mixed with inert binders (plastic explosives and dynamites).

Of the approximately 20 compounds that may be used for this purpose, the wastes that are thermally treated at the 20,000-Pound OD Unit use a very limited number of energetic materials. These materials include: nitroglycerin, nitrocellulose, trinitrotoluene (TNT), PETN, trinitrophenylmethylnitramine (tetryl), cyclotrimethylene trinitramine (RDX), and cyclotetramethylenete trinitramine (HMX)).

Many binary explosives are formulated from the components listed above. For example, cyclotol is a mixture of RDX and TNT, octal refers to mixtures of HMX and TNT, and pentolite refers to mixtures of PETN and RDX. None of the binary explosives are thermally treated in the 20,000-Pound OD Unit.

Plastic explosives are formulated by blending certain explosives listed above with binders, waxes, and oils. The energetic materials most commonly used for plastic explosives are RDX, TNT, and nitrocellulose. Certain waste munitions thermally treated at the 20,000-Pound OD Unit incorporate the energetic material's plastic explosive.

Nitroglycerin has been discussed previously in conjuction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately 13°C. The specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at 20°C. Nitroglycerin decomposes with gas evolution at temperatures of 145°C. The published explosion temperature for nitroglycerin is 222° with evolution of approximately 368 Kcal/mol of heat and 715 ml of gas per gram of charge. Nitroglycerin is extremely sensitive to shock, being detonated by a 2 kg weight dropped from a height of 16 cm in the Bureau of Mines reactivity tests. For this reason, nitroglycerin is compounded with other energetics or inerts to facilitate handling. In pure form, it may be absorbed through the skin into the circulatory system and cause increased pulse rate and blood pressure.

Nitrocellulose is a mixture of esters formed by the nitration of cellulose with a mixture of sulfuric and nitric acids. As used in military formulations, nitrocellulose contains a minimum of 12.2% nitrogen. Although nitrocellulose is not truly soluble in any solvent, certain alcohols, ketones, and aromatic nitro compounds will disperse nitrocellulose as colloidal suspension. Water has no solvent action upon nitrocellulose but is absorbed to between 2 to 3% with the resultant deterioration to the unstable form.

Cellulose nitrate has specific gravity of 1.65. The explosive temperature for cellulose nitrate is approximately 230° with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal mol of heat upon detonation that is accompanied by evolution of approximately 700mL of gas per gram charge. Nitrocellulose is extremely sensitive to spark ignition if handled in dry form. The shock sensitivity of nitrocellulose is greater than that of nitroglycerin and is listed as detonation by a 2 kg weight dropped from a height of 9 cm in the Bureau of Mines test.

TNT is available in six isomeric forms although 2,4,6-TNT is the form most commonly utilized. Pure TNT fuses at 80.7°C, has a specific gravity of 1.65, and liquid viscosity of 13.9 CP at 85°C. TNT is among the least sensitive of military explosives, requiring an 85-cm height for detonation by 2 kg weight in the Bureau of Mines test. In addition, TNT has a very high explosion temperature (475°C) and is sensitive to electrical spark only if finely divided. Upon detonation, TNT 245 Kcal/mol of heat and 730 mL of gas per gram of charge. The heat of combustion of TNT is 821 Kcal/mo. TNT derives its value largely from its stability during storage and the ability to melt cast components.

PETN is an aliphatic nitrate formed by the nitration of pentaerythritol [$C(CH_2OH)_4$]. Highly purified PETN melts at 141°C and has a crystal density of 1.76. The heat of combustion of PETN is 600 Kcal/mol. Upon detonation at 215°C, PETN yields 439 Kcal/mol of heat and 790 ml of gas per gram of charge. PETN has an impact sensitivity similar to nitroglycerin (17cm) but is not sensitive to electrical detonation.

Tetryl, (2,4,6-trinitrophenylmethylnitramine) is a nitro derivative of methylsubstituted picramide (trinitroaniline) that is formed by nitration dimethlyaniline. Pure tetryl melts at 130°C and has a crystal density of 1.73. Tetryl yields 324 Kcal/mol of heat with expulsion of 760mL of gas per gram at its explosion temperature of 257°C. The heat combustion of tetryl is 840 Kcal/mol. Tetryl is less sensitive to impact than nitroglycerin but is greater sensitivity than TNT with detonation occurring with a 2 kg weight dropped from height of 26 cm in the Bureau of Mines test. Tetryl is toxic if inhaled with a recommended permissible exposure level (PEL) of 1.5 mg/m^3.

Cyclotrimethylene trinitramine (RDX) or TU is a colorless solid that melts at 204° and has a crystal density of 1.82. Impact tests show RDX to be of similar sensitivity to tetryl with detonation occurring at 32cm. RDX is the second most powerful military explosive with greater power than tetryl or PETN and nearly equivalent power to nitroglycerin. The heat of detonation from RDX is 285 Kcal/mol with formation of 908mL gas per gram charge. The stability of RDX is similar to that of TNT.

HMX is formed during synthesis of RDX. In pure form, HMX has a crystal density of 1.87 and a fusion temperature of 276°. The heat of combustion of HMX is 660 Kcal/mol and the heat of explosion is 390 Kcal/mol. The explosion temperature of HMX (337°C) is greater than RDX but HMX is of equivalent power to RDX upon detonation, yielding approximately 810 mL of gas per gram of charge. HMX is of limited toxicity as is RDX. Unlike RDX, the tetranitramine is seldom used in single compositions but is more commonly blended with TNT under the name Octol. The high explosive device used to detonate these waste items is composition C-4. This high explosive consists of approximately 90% RDX and 10% polyisobutylene.

Inspection of the residuals is performed as soon as the detonation has occurred. Furthermore, the surrounding area is thoroughly inspected to find any ordnance that may have ejected from the unit. If any untreated energetic device is found, treatment is repeated.

D-8d(2) EXPECTED PERFORMANCE/TEST RESULTS

Solid residuals are sampled annually according to the protocols described in the Section C. Upon receipt of the analytical results, the data will be submitted to NMED to demonstrate the effectiveness of the treatment and that no hazardous constituents remain. A letter submittal that identifies sampling location and analytical results will also be submitted. If contamination exists, further action will follow as described in Attachment C-1 to Section C. For areas where contamination is verified to exceed action levels, Holloman AFB, in accordance with NMED, may choose to further evaluate the exceedence using a site-specific risk-based approach, additional sampling results, or remediate affected soils. ~~, the removal, as outlined in Section D-8d(3) will also be communicated.~~

Gaseous reaction products are not monitored during combustion. The expected gas phase products and downwind concentrations are addressed in Section E-3.

D-8d(3) RESIDUALS MANAGEMENT

Although solid residuals rarely remain after detonation, solid residuals that result from thermal treatment remain in the ~~trench~~ depressions unless the sampling results show that the residual levels in soils is above action levels and removal is deemed appropriate. ~~sampling results indicate the need for removal. The following contamination criteria were selected as indicative that residuals from any given treatment event must be removed from the unit:~~

~~**(1)**~~	~~TCLP (metals)~~	~~>TCLP levels~~
~~**(2)**~~	~~organic nitrogen/$N0_3$~~	~~>1000 ppm~~
	~~(indicates nitroglycerin/nitrocellulose)~~	
~~**(3)**~~	~~TNT/RDX~~	~~>1000 ppm~~
~~**(4)**~~	~~Antimony~~	~~10 ppm~~
	~~(1000 times regulatory standard)~~	

~~If these values are exceeded, the residuals are removed from the subunit. In addition to removal of the residuals, the first 6 inches of soil in the trench bottom will also be containerized, labeled, and transported to the DRMO facility as hazardous waste.~~

~~After removal of the first 6 inches, the soils underlying to a depth of 1 foot will be sampled and analyzed to determined if these criteria are met. Successive removal and sampling at 1-foot increments will be performed until the above criteria are achieved.~~

Attachment D-1
Groundwater Monitoring Waiver

SECTION C

WASTE CHARACTERISTICS

This section describes the physical and chemical characteristics of the waste that is thermally treated at the 20,000-Pound OD Unit. The waste analysis plan that identifies sampling and analytical protocols is provided in Section C-2 and Attachment C-1.

The 20,000-Pound OD Unit consists of a cleared area ~~with two pits which are excavated within this zone in order to thermally treat waste-propellant devices~~ within which waste explosives and propellant devices are detonated. The wastes that are treated ~~in these excavations~~ are considered characteristically hazardous on the basis of reactivity (D003). During treatment, ~~a pit is partially filled with subject waste~~ the waste to be treated is placed on top of the ground. Detonation charges that consist of cyclotrimethylene trinitramine (RDX) explosive are added to the pile in order to detonate the waste. The detonation reaction renders the explosive wastes nonreactive and results in both solid and gaseous by-products. Depending upon combustion conditions, the gaseous by-products will consist of carbon monoxide (CO), carbon dioxide (CO_2), water (H_2O), nitrogen (N_2), and various nitrogen oxides (NO_x). Solid by-products include casings from the waste and possibly trace concentrations of incompletely oxidized reactive material. Reaction by-products that are solid will be retained in the ~~pit~~ depression created by the explosive force (except for ejected components), but the gaseous reaction by-products ~~are allowed to~~ vent to the atmosphere. These solid by-products will be gathered and re-detonated or drummed for proper disposal. Due to the difficulties and obvious hazards associated with collection of gas samples in the immediate vicinity of the detonation zone, this plan does not address the gas phase reaction by-products. An assessment of the gaseous constituents released during combustion is provided in Section E-3.

C-1 CHEMICAL AND PHYSICAL ANALYSIS

Detailed chemical and physical analyses have been performed by the Department of Defense for all military ordnance material. These analyses have been compiled into ordnance material specifications and “Technical Supply Bulletins.” Due to the vast

amount of knowledge on the composition of ordnance materials that has been assembled for each particular ordnance material, and the dangers involved in deactivating a bomb or explosive, samples of the waste ordnance materials are not routinely obtained and chemically analyzed. Instead, a well-defined knowledge of the constituents used in making the ordnance materials has been compiled. This understanding of the waste constituents is presented in lieu of extremely dangerous predetonation sampling and analysis. Chemical analysis would not yield additional information and could pose a risk to sampling and analysis personnel.

The wastes that are treated in the 20,000-Pound OD Unit are generally propellant devices and explosives with expired shelf lives. ~~Only~~ Rocket motors exceeding 300 pounds are regularly treated at the 20,000-Pound OD Unit. Similar constituents are used in the formulation of the different items, but the quantity of specific energetic materials varies. In addition to the energetic material, the waste consists of the unit metallic components associated with these devices such as the casing. The total mass of the energetic material is typically limited to less than ~~1000~~ 10,000 pounds per device. The energetic materials contained in these wastes are considered characteristically hazardous on the basis of reactivity (D003). Nitroglycerin (P081) is listed on the basis of its reactivity. The reactive wastes are identified as such because these materials are explosives that deflagrate or detonate when subjected to shock or heat. ~~The ignitable components of these wastes are strong oxidizers.~~

Single-base propellants contain nitrocellulose (with 12.5-13% N) as the primary constituent. In addition to nitrocellulose, single-base propellants contain organic nitro compounds, stabilizers, and metal salts. The organic nitrocompounds commonly employed in single-base systems include trinitrotoluene and dinitrotoluene. Organic nitro compounds are utilized to disperse the nitrocellulose as colloidal particles. Stabilizers are required in the composition due to the tendency of nitrocellulose to decompose during storage, particularly as moisture is absorbed. Decomposition of nitrocellulose is an exothermic reaction that is indicated initially by an acid odor or condition that progresses to emission of red fumes and spontaneous ignition as the propellant becomes unstable. Due to this condition, nitrocellulose-based propellants are stored in bulk, are vigorously monitored for pH changes, and are compounded with stabilizers used to retard decay. Typical stabilizers used to retard this condition include

diphenylamine, nitrodiphenylamine, diethyl diphenylurea, and petroleum jelly (cordite). As decomposition proceeds, nitrophenylamines, nitroureas, and nitroanilines are formed. This variety of the analogs will be present in waste single-based propellants. However, as the original concentration of the stabilizer seldom exceeds 1.0%, the concentration of those decomposition products will be in the parts per thousand range.

In addition to nitrocellulose fuel, nitro-based dispersion agent, and stabilizer certain propellants incorporate small quantities of metal compounds and elements. These compounds include potassium sulfate, tin and graphite that are not characteristically hazardous.

Double-base propellant formulations include both nitrocellulose and nitroglycerin with limited quantities of stabilizers and additives. Nitroglycerin serves as both the gelatinizing agent and a fuel in these compositions. In addition to the nitroglycerin, small quantities of dibutylphthalate, diethylphthalate, or triacetin are compounded to enhance colloidal suspension of the nitrocellulose. The stabilizing agents for double-base compositions do not differ from the stabilizers common to single-base systems. However, the metallic additives for double-base systems may include barium or potassium nitrate, calcium sulfate, calcium carbonate, or lead stearate in addition to the metallics used in single-base compositions.

The relative concentrations of these components in propellants varies depending upon the intended end use. In general, nitrocellulose is the predominant constituent and is present in concentrations of 50 to 70%. Nitroglycerin is the second largest constituent in the propellant composition. These two compounds constitute greater than 95% of the standard military double-base formulations. The addition of inerts and stabilizers provides the balance to greater than 99% of the formulation, with less than 1.0% of the formulation composed of various nitrates or lead stearate.

Composite propellants consist of ammonium nitrate ~~pirate~~, an inorganic oxidant such as potassium nitrate, and an organic binder. These propellants are heterogeneous solids that may be press formed to the desired shape. Composite formulations are not handled at the 20,000-Pound OD Unit.

Although the term “colloidal suspension” has been applied to propellants, these compositions are completely solid without free liquids. Physically, propellant compositions consist of powders that are incorporated into solid or waxlike binders and pressed into strips, cords, and other linear shapes. Although dry nitrocellulose is unstable, incorporation of the binders renders the mixture relatively stable. Propellants, including double-base formulations, are not sensitive to shock and cannot be ignited by ordinary shock or frictional effects. Propellants are sensitive to electric spark only if the material has been finely divided and is present as dust. Thus, propellants present a fire hazard to the degree that a sufficiently strong heat source is available to ignite the composition. Unless finely divided, ignition usually requires either open flame or detonation of a high explosive placed adjacent to the propellant material.

The composition of commonly utilized single-base and double-base propellants is provided in Table C-1. Specific propellants that have been thermally treated at the 20,000-Pound OD Unit are discussed in a future section.

Table C-1
Standard Compositions (%) for Single- or Double-Base Propellant

Nitroglycerin has been discussed previously in conjunction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately 13° C. The specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at 20°C. Nitroglycerin decomposes with gas evolution at temperatures of 145°C. The published explosion temperature for nitroglycerin is 222°C, with evolution of approximately 368 Kcal/mol of heat and 715 mL of gas per gram of charge. Nitroglycerin is extremely sensitive to shock, being detonated by a 2 kg weight dropped from a height of 16 cm in the Bureau of Mines reactivity tests. For this reason, nitroglycerin is compounded with other energetics or inerts to facilitate handling. In pure form, it may be absorbed through the skin into the circulatory system and causes increased pulse rate and blood pressure.

Nitrocellulose is a mixture of esters formed by the nitration of cellulose with a mixture of sulfuric and nitric acids. As used in military formulations, nitrocellulose contains a minimum of 12.2% nitrogen. Although nitrocellulose is not truly soluble in any solvent, certain alcohols, ketones, and aromatic nitrocompounds will disperse nitrocellulose as a colloidal suspension. Water has no solvent action upon nitrocellulose but is absorbed to between 2-3% with the resultant deterioration to the unstable form. Cellulose nitrate has a specific gravity` of 1.65. The explosive temperature for cellulose nitrate is approximately 230°C with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal/mol of heat upon detonation that is accompanied by evolution of approximately 700 mL of gas per gram charge. Nitrocellulose is extremely sensitive to spark ignition if handled in dry form. The shock sensitivity of nitrocellulose is greater than that of nitroglycerin and is listed as detonation by a 2kg weight dropped from a height of 9 cm in the Bureau of Mines test.

C-1a WASTE IN CONTAINERS

~~Most~~ All waste that will be treated at the 20,000-Pound OD Unit will be transported to the treatment area in the original product container or other appropriate packaging. Propellants are contained within chambers that are generally cylindrical in shape and constructed of aluminum and steel. A primary consideration in development of propellant, explosive, or pyrotechnic systems is long-term storage stability which

requires compatibility of container and the energetic material.

Receipt of the waste in the product container, combined with the fact that commonly-used military propellants are compatible with one another, ensures the fact incompatible wastes are not mixed. The reactive wastes to be treated at the 20,000-Pound OD Unit are solid in nature and contain no free liquid.

C-1b WASTE IN TANKS --Not Applicable

C-1c WASTE IN PILES --Not applicable

C-1d WASTE IN IMPOUNDMENTS --Not Applicable

C-1e WASTE IN INCINERATORS --Not Applicable

C-1f WASTE IN LANDFILLS --Not Applicable

~~After each treatment event in the 20,000-Pound OD Unit, the residuals are covered with backfill material. The inspection requirements discussed in Section D and the general nature of the waste ensure that residuals no longer exhibit the characteristics of ignitability or reactivity. The waste analysis requirements discussed in Section C-2 are designed to ensure that the residuals are not EP toxic, that hazardous constituents are not present at levels of regulatory concern, and confirm that the waste is no longer ignitable or reactive. Residuals that do not meet these criteria are removed from the unit as described in Section D. Thus, the closed trench operates as a solid waste landfill, but is not a land disposal unit for hazardous waste landfill, but is not a land disposal unit for hazardous waste.~~

C-1g WASTE IN LAND TREATMENT --Not Applicable

C-1h WASTE IN MISCELLANEOUS UNITS

This section addresses the specific wastes that have been treated at the 20,000-Pound OD Unit and are expected to require continued treatment at this unit. The waste

characteristics and compositions previously presented in this section were provided to fulfill requirements for a general description of the waste characteristics. The previously provided information also gives background data in the unexpected event that a permit modification is required in order to thermally treat any of the compositions that differ slightly from the wastes that have been historically managed.

This section also addresses the characteristics of the waste that must be known for proper management of the waste. This information is derived from published sources. Analysis to support the published data is not required because of the limited deviation allowed within the product specifications that manufacturers of military propellants must follow. The waste that is treated at the 20,000-Pound OD Unit has essentially the same composition as serviceable propellants, but is ~~considered hazardous waste~~ being disposed of because of shelf-life exceedance, deterioration during storage, or failure to complete exhaust during testing of motors.

In general, the characteristics of the waste that must be known are:

- Presence of free liquids,
- Basis for hazard designation,
- Waste composition,
- Ignition or explosion temperature,
- Heat of combustion and/or detonation,
- Sensitivity to shock or electrical ignition,
- Storage stability (tendency to decompose during storage),
- Compatibility with container or other energetic material, and
- Solubility characteristics.

It must be noted that the unique nature of these materials presents difficulties in development of these data in all instances. In some instances, the parameters are not readily measured because of the instability of the material. For many energetic materials, the particle size, degree of subdivision, compressed density of the material in the ordnance, age, and atmospheric conditions affect the value derived for these parameters. The same material may provide different values for certain parameters for no apparent reason. Thus, the published data presented in this section represents the accepted values

for those parameters derived from various tests.

Table C-2 identifies all explosive compounds and other substances used or treated at the OD Unit. As shown in Tables C-1 and C-2, there are several explosive materials that are used in a variety of combinations to manufacture explosives and propellant devices. All of these explosives are solid materials that do not contain liquids. The main explosive materials and a description of each are as follows:

- Black Powder—Black powder is the oldest known explosive material. It is a composite material made from saltpeter (potassium nitrate), charcoal, and sulfur. It is a lower powered explosive and is commonly used in time fuses, igniters, and detonators.

Table C-2
Explosive Compounds Used or Treated at the OD Unit

Table C-2 (continued)
Explosive Compounds Used or Treated at the OD Unit

Table C-2 (continued)
Explosive Compounds Used or Treated at the OD Unit

- Ammonium Nitrate—Ammonium nitrate is the least sensitive of military explosives and must be initiated by a booster charge to ensure successful detonation. Ammonium nitrate is commonly used in composite explosives where it is combined with a more sensitive explosive. Ammonium nitrate is highly hygroscopic (readily absorbs moisture) and must be kept in a waterproof container.

- Amatol—Amatol is a mixture of ammonium nitrate and TNT that is commonly used as a substitute for TNT in bursting charges. The most common mixture of amatol is 80/20 (80% ammonium nitrate and 20% TNT). Because of its ammonium nitrate content, Amatol is highly hygroscopic and must be kept in a waterproof container.

- Military Dynamite—Military dynamite is a composite explosive that contains 75% cyclotrimethylene trinitramine (RDX), 15% TNT, and 10% desensitizers and plasticizers. Military dynamite is considerably more stable than commercial dynamites due to the absence of nitroglycerin.

- Trinitrotoluene (TNT)—TNT is the most commonly used military explosive. It is used alone or in conjunction with other explosives for composite explosives. TNT is commonly used for boosters, bursting charges, or demolition charges.

- Tetryl—Tetryl is commonly used alone as a booster charge. It can also be used as a bursting or demolition charge and, at times, can be used in composite charges. Tetryl is more powerful and more sensitive than TNT. Tetryl explosives are being replaced with RDX and PETN explosives due to the increased power and shattering effects of these two latter explosives.

- Pentolite—Pentolite is a mixture of PETN and TNT. The most common mixture of pentolite is 50% PETN and 50% TNT. This explosive is very powerful, has a high detonation rate, and is used in certain shaped charges.

- Nitroglycerin—Nitroglycerin is a highly powerful explosive and is comparable to RDX and PETN. It is commonly used as the base material for commercial dynamites. Nitroglycerin is highly sensitive and is affected by extreme temperatures. Due to its sensitivity, nitroglycerin is not typically used as a military explosive.

- Composition B—Composition B is a composite explosive containing 60% RDX, 39% TNT, and 1% wax. Because of the high RDX content, Composition B is more sensitive than TNT and is primarily used as the main charge in shaped charges.

- Composition C4—Composition C4 is a composite explosive containing 91% RDX and 9% nonexplosive plasticizers. Composition C4 is very stable over a wide range of temperatures and is only slightly water soluble. This explosive is used mainly as a bursting charge.

- Composition A3—Composition A3 is a composite explosive containing 91% RDX and 9% wax. The wax coats the RDX particles and acts as a desensitizer as well as a binder material. Composition A3 is used as a booster charge in newer charges and torpedoes as well as in high explosive plastic projectiles.

- Pentaerythrite Tetranitrate (PETN)—PETN is very sensitive and is one of the most powerful military explosives. PETN is used in boosters, detonating cords, blasting caps, and in composite explosives. PETN is not water soluble.

- Cyclotrimethylene trinitramine (RDX)—RDX is very sensitive and, like PETN, is one of the most powerful of military explosives. It is often used alone as the base charge in M6 (electric) and M7 (non-electric) blasting caps. RDX can also be desensitized and used for sub-boosters, boosters, bursting charges, and demolition charges. RDX is commonly used in the manufacture of Composition A, B, and C explosives.

- Composition B4—Composition B4 is a composite explosive that is very similar to Composition B with 60% RDX, 39.5% TNT, and 0.5% calcium sulfate. This explosive is used in newer shaped charges and bangalore torpedoes.

The composition of ~~the~~ specific propellant devices that have been treated at the 20,000-Pound OD Unit, and that are expected to require continued treatment, is provided in Table C-3. Additives to the double-base propellant compositions are also identified in Table C-3. Single-base or composite propellants are not thermally treated at the 20,000-Pound OD Unit. In addition to the specific formulations for the propellants, Table C-3 identifies the components present in primer compositions or the initial detonating agents associated with these energetic items. The primer is not always treated in conjunction with the propellant. Table C-4 presents data on the characteristics of the constituent used in these propellants. Data on the explosive train (that is a serviceable ordnance and not waste) is also presented in these tables.

Table C-3
Composition of Specific Propellants Thermally Treated at the OD Unit (also included is the RDX detonator)

Table C-4
Characteristics of constituents in Propellants of Explosives Thermally Treated at the OD Unit (a,b)

Three waste characteristics relevant to proper handling and treatment are not addressed in these tables: (1) the presence of free liquids, (2) compatibility of these wastes with the container, and (3) compatibility with other energetic materials. As previously indicated, the energetic compositions used for these military applications contain no free liquid and consist of finely divided powders or wax-like materials compressed to a variety of shapes. These wastes are managed in the original product container and the materials of the casing were specifically selected at the time of design to be compatible with the energetic material to ensure longevity during storage. Thus, further consideration of these compatibility concerns is not warranted and is prohibitive because of the dangers inherent in any attempt to re-package these materials. Furthermore, these wastes are not re-packaged or stored at the unit. The energetic formulations that are thermally treated at the 20,000-Pound OD Unit are mutually compatible as demonstrated by the fact that these materials are often blended together in a single formulation or conjointly packaged in a single device. In addition to their mutual compatibility, the energetic materials are not removed for blending purposes and, therefore, mixing of incompatible wastes does not occur. Although some limited data concerning reactivity toward water and other reagents are provided in this section, the wastes treated at the 20,000-Pound OD Unit are not mixed with any reagents incidentally or to effect treatment. Such data are provided solely for informational purposes.

~~The wastes that are treated in the 20,000-Pound OD Unit are characteristically hazardous by reactivity or ignitability. Certain constituents, present in trace amounts, are EP toxic. However, the presence of these constituents does not necessarily render the entire waste material EP toxic. The only waste device that may incorporate EP metals is the detonating squib noted in Tables C-3 and C-4. The primer or detonator used to effect treatment is not a waste.~~

The shock sensitivity of energetic materials may be determined by the Bureau of Mines impact test. The shock sensitivity data provided in this section are based on the Bureau of Mines method. In practice, this method involves placement of 0.02 gram of the subject material in a brass cup that is subsequently impacted by a 2kg weight dropped from a measurement height. Sensitivity is recorded as the height required to initiate detonation in one of ten tests.

Sensitivity to friction is measured by the pendulum test. In this method, a specifically weighted bare-metal shoe is attached to a pendulum designed to pass in contact with a grated anvil containing 7.0 grams of energetic materials 18 times during the test. This sensitivity test is utilized less often than impact and is, therefore, not reported.

Heat and electrical spark sensitivity are determined by several techniques. The most reliably reported data are the explosion temperature as determined by submersion of the subject material in a vat of heated bismuth alloy. Both the explosion temperature and any separately noted spark sensitivity data from energetic materials are reported in this section.

C-2 WASTE ANALYSIS PLAN

This section addresses the parameters of concern for waste treated at the 20,000 OD Unit. The rationale for the selection of these parameters, sampling methods, analytical protocols, and frequency of analysis are described. Parameters and rationale for characterization of waste is discussed in parts C-2a(1) and C-2a(2), which cover predetonation and postdetonation, respectively.

Holloman AFB has never been used for the research and development of nuclear, chemical welfare, or other exotic warfare types of weapons. The OD Unit is used solely for the disposal/treatment of conventional waste-ordnance, munitions, incendiaries, propellants, and rocket motors. The only munitions delivered or disposed of at Holloman AFB have been conventional live and training munitions. Therefore, the chemical components and combustion by-products are consistent with what is typical for military munitions items; thus, the emphasis of sampling and analysis for the OD Unit should be to search only for the constituents present in these types of wastes.

~~Functionally, the prime constituents are alkoxy nitrates. Inorganic nitrates, chlorates, or peroxides, reactive metals, and inert components (casings and projectiles) are also present. The individual relative components that require treatment are well defined in terms of constituents and are characteristically hazardous by reactivity and/or ignitability. Although certain other constituents are EP toxic in themselves, it is~~

~~questionable that these components render the entire waste component EP toxic.~~

The nature of the treatment by-products is dependent upon the category of device from which the waste is derived. Propellant constituents will be converted largely to the gaseous products CO_2, CO, H_2O, N_2, and, to some degree, NOx. Some extremely limited possibility exists that these materials may fail to entirely decompose.

The nitrate oxidant from primers or detonators will convert to sodium or potassium nitrite ($NaNO_2$, KNO_2). Other oxidants are converted to the oxide. Fuels such as antimony sulfide or thiocyanate are converted to the oxide or sulfate.

The sampling and analysis plan outlined in Attachment C-1 ~~in this section~~ focuses on solid reaction products because of the hazards associated with plume sampling in the vicinity of the treatment zone. Section E-3 addresses "Air Assessment".

C-2a(1) PARAMETERS AND RATIONALE (PREDETONATION)

Waste analysis will not be performed prior to the treatment of these wastes. Sampling prior to treatment would so greatly increase the potential for accidental detonation, with resultant property damage and personal injury, that such efforts are not warranted. The containers that hold these energetic materials (product or waste) are sealed in accordance with exceedingly specific manufacturing specifications designed to prolong storage stability and reduce the potential for unplanned detonation or ignition from impact. For example, nitrocellulose propellant mixtures are hygroscopic to 3-4 weight percent if exposed to moist air. The hydrolysis that accompanies exposure of nitrocellulose to air (even at low relative humidity values) renders the material unstable and evolution of NO_2 or auto-combustion occur. Dismantling of the devices (that would be required for sampling) not only increases hazard by exposure of material but increases the potential for detonation due to the friction and shock sensitivity of the materials.

Additionally, the composition of these materials is well defined on the basis of published literature and tightly controlled manufacturing specifications. Thus these materials are analogous to pure discarded commercial products for which sampling would only prove redundant. Prior to treatment of any waste not specifically identified in

Section C-1, a complete listing of all ingredients common to that energetic item will be obtained to determine its suitability for treatment in the 20,000-Pound OD Unit.

The use and handling of these materials is tightly controlled and the device is sealed; therefore, the possibility to mix unspecified items with the energetic materials does not exist. No other wastes are treated in conjunction with these devices in the 20,000-Pound OD Unit because joint treatment is specifically prohibited by Technical Orders.

C-2a(2) PARAMETERS AND RATIONALE (POSTDETONATION)

Post treatment analysis of residuals presents less risk to sampling and analytical personnel than attempts to perform predetonation sampling because successful treatment renders the waste non-reactive. Thermal treatment of propellants converts the alkoxynitrates to gaseous products. However, because it is technically impractical to sample evolved gas sampling in the treatment zone, the focus of this plan is the solid residuals that may remain in the pit.

Attachment C-1 contains a detailed Sampling and Analysis Plan (SAP) that covers all aspects of post-detonation waste sampling at the OD Unit. Specific topics covered in the SAP include: sampling approach and rationale, sampling procedures and methodology, health and safety procedures, sample handling and chain of custody (COC), sample documentation, laboratory procedures, quality assurance/quality control (QA/QC), and data evaluation methods. A summary of analytical methods and sampling frequency is provided below.

Samples of the solid residuals and underlying soils will be prepared and analyzed according to protocols from *SW-846, Test Methods for Evaluating Solid Waste*, Third Edition. Samples will be analyzed for all toxic metals, including priority pollutant metals (listed in the New Mexico Hazardous Waste Management Regulations-7, Part V, Appendix IX), explosive residues, and soil moisture. Section 3.2 of the SAP contains the specific test methods and lists of analytes that will be measured, as well as the rationale for their selection. Attachment C-1, Section 7 discusses details of laboratory protocols and quality assurance/quality control procedures.

Samples of the treatment residuals and underlying soils will be taken annually to demonstrate the effectiveness of the treatment and to ensure that hazardous wastes are not present. This frequency was selected to ensure effectiveness of treatment and prevent storage of hazardous waste in the area. A stratified random sampling methodology will be used to collect representative samples. Attachment C-1, Section 4 explains in detail the sampling methodology.

~~C-2a(2) PARAMETERS AND RATIONALE (POSTDETONATION)~~

~~Post treatment analysis of residuals presents less risk to sampling and analytical personnel that attempts to perform predetonation sampling because successful treatment renders the waste non-reactive and non-ignitable. Thermal treatment of propellants converts the alkoxynitrates to gaseous products. The gaseous products will consist primarily of N_2, CO, CO_2, H_2O, and to some degree NO_x. However, because of the difficulties and hazards of gas sampling in the treatment zone, the focus of this plan is the solid residuals that remain in the pit.~~

~~The potential solid residues include TCLP metals, the original energetic constituents, decomposition products from the energetic materials, the original inerts and additives, and the decomposition products of the inerts. The TCLP metals result from oxidants present in primers. Decomposition of the oxidants yields the TCLP metals in the form of nitrites, chlorides, and oxides that are expected to remain in the solid treatment residues. Thus, certain TCLP metals were selected as parameters of concern for post-treatment sampling and analyses. However, selection of the entire spectrum of TCLP metals was considered unnecessary because certain of these metals are not present in the input materials. The TCLP metals that result from primer or detonation compositions are Ba or Pb, but are contributed to a limited extent. Certain detonation charges may contain mercury fulminate, although the use of this compound in ordnance has been largely discontinued in favor of lead azide or styphnate. Antimony sulfide, present in certain primer compositions, was also selected as a parameter of concern.~~

~~The energetic materials utilized in propellants or explosives contain highly unstable bonds that are readily ruptured during combustion or detonation. The ready disassociation of these compounds with a resultant high gas volume yield is the rationale for their selection as energetic material. During combustion and detonation of these materials, conversion to elemental gases is essentially complete. Thus, the potential for residues that consist of the original constituent is limited. Poor oxidative conditions exert little influence upon decomposition of those types of materials since a criterion for the~~

~~selection of these compounds as explosives is a high-oxygen balance. This criterion is imposed to ensure that the decomposition reactions are driven essentially to elemental gases in order to yield the greatest power upon detonation.~~

~~The possibility for formation of lower molecular weight analogs of the original species is even less than the potential for unreacted energetic species. Both the high-oxygen balance and inherent bond instability in the molecules contribute to complete disassociation once rupture of the bonds is initiated. For example, carbon-to-carbon bonds have disassociation energies on the order of 100-230 KCal/mol, but the dissociation energies for the carbon-nitrogen bonds in aryl structures is on the order of 50-65 KCal/mol. Thus, the nitro groups are readily released from the molecule. Once fragmentation occurs, the NO_2 radical readily oxidizes the hydrocarbon species to CO, CO_2, and H_2O with the nitro group reduced to elemental nitrogen.~~

~~Although the potential for unreacted energetic materials is extremely limited, certain of these were selected as parameters of concern to demonstrate the effectiveness of treatment.~~

~~On the basis, RDX, because of its use to initiate detonation, was selected as a parameter of concern. Analysis of the residual for nitrate and organic nitrogen was selected as parameters to measure the completeness of the combustion of nitrocellulose and nitroglycerin that have lower decomposition temperatures than RDX. In addition, the samples will be tested for reactivity to confirm that reactive wastes have been completely treated. Analysis for any lower molecular weight analogs was not considered because of the tendency of the original constituents to totally decompose. Additionally, prediction of such constituents on the basis of thermo-chemistry and reaction kinetics is precluded due to the complexity of the reaction in the detonation.~~

~~The inerts that are present in the compositions include the binders and additives. Of these materials, only dinitrotoluene, that is occasionally incorporated in propellants, is considered a hazardous constituent. Although it is present in a limited number of compositions and expected to decompose under these conditions to NO_x, N_2, CO, H_2O, and CO_2, it was selected for analysis.~~

~~The parameters of concern are summarized in Table C-4. These include certain TCLP metals, antimony, RDX, NO_3-N, Total Kjeldahl Nitrogen (TKN), and dinitrotoluene~~.

~~C-2b TEST METHODS~~

~~Samples of the solid residuals and underlying soils will be prepared and analyzed according to protocols from *SW-846, Test Methods for Evaluating Solid Waste*, Third Edition. The TCLP metals are prepared by analysis of EP extracts by Method 3010 and Method 3050 for total metals. Mercury is analyzed by cold vaporatomic absorption, Methods 7470 and 7471. If aluminum, chromium, or iron interferences prevent quantification of antimony or lead, these analytes will be quantitated by atomic absorption. TKN is prepared by digestion of the residues or soil in sulfuric acid with the digestrate analyzed by ion selective electrode, colormetric, or titrimetric techniques as specified in Method EPA 351.3 (*EPA-600/4-79-020, Methods for chemical Analysis of Water and Wastes.*~~

~~No approved method exists for the quantification of RDX or reactivity. The method selected for this analysis was liquid chromatography as specified *in Journal of Chromatographic science 23:532-4*, 1985. The test method selected to determine reactivity was the Bureau of Mines Impact Test. This method was briefly described in Section C-1. The analytical methods for residuals and soils from the pit are outlined in Table C-4 on the following page.~~

~~C-2c SAMPLING METHODS~~

~~Samples of the treatment residuals and underlying soils will be taken annually to demonstrate the effectiveness of the treatment and to ensure that hazardous wastes are not present. A random sampling methodology will be used to collect representative samples.~~

~~Selection of random samples will be facilitated by division of the pit bottom surface into grids. Each grid dimensions will be approximately 3 feet x 3 feet to yield 300-500 grids. Each grid will be successively numbered along the rows until each grid is numbered.~~

~~As described in *EPA/530-SW-84-012, Waste Analysis Plans--A Guidance Manual*, a random number table will be used to select the grids for sampling locations. A description of the use of the random number table for posttreatment and sub-unit closure is provided with the table as Exhibit C-1. The number of samples to be taken is determined by application of ASTM D140-70, *Standard Method of Sampling Bituminous Materials*. The selection table from this method is also provided as Exhibit C-1.~~

~~This sampling methodology will result in division of each pit bottom surface into approximately 300-500 grids that are considered to represent both surface layer and subsoil residuals. Thus, a total of seven or eight samples of surface residuals and~~

~~subsoils will be taken.~~

~~Soil samples will be taken to a depth of approximately 2 feet with a handheld auger. A minimum of three corings will be taken from the center of each grid and composited in a glass pan that has been precleaned with a soap/water solution and rinsed in deionized water, acetone, and deionized water. Cleaning solution will be brought to the unit to allow cleaning of equipment between each grid sampled. Both the residual and soil samples will be homogenized by the use of a separately dedicated stainless-steel spoon.~~

~~After the sample is composited, a quantity of either the residual material or soil will be transferred to two 8-oz, wide-mouth glass jars with teflon-lined screw-type lids that have been precleaned to EPA protocols. One sample jar will be collected for metals and one for organics. A sufficient quantify of samples will be transferred to the container to completely fill the container volume. The sample jar will be tightly closed, taped, and a sample identification/analyitcal request form will be attached to the container. A corresponding chain-of-custody sample log sheet will be completed by the sampler. Both the chain-of-custody log and the sample tag will identify the grid location from which the cample was taken. Solid samples in the field are preserved by placement of the sample container in an ice chest that contains an ice/water mixute.~~

~~Table C-4. Parameters of Concern for Treatment Residuals in the 20,000lb ED Area~~

~~Parameter~~	~~Preparation Method~~	~~Analytical Method~~
~~Specific EP Metals~~	~~1310~~	~~1310~~
~~Barium~~	~~3010,3050~~	~~6010~~
~~Mercury~~	~~7470, 7471~~	~~7470, 7471~~
~~Lead~~	~~3010, 3020, 3050~~	~~6010, 7421~~
~~Antimony~~	~~3020, 3050~~	~~6010, 7041~~
~~Cyclotrimethylenetrinitramine~~	~~Lc[a]~~	~~L.C.~~
~~NO_2 - NO_3~~	~~9200~~	~~9200~~
~~Total Kjeldahl Nitrogen~~	~~351.3~~	~~351.3~~
~~Reactivity~~	~~NA[b]~~	~~Bureau of Mines Impact Test~~
~~Dinitrotoluene~~	~~3540, 3550~~	~~8250~~

~~[a]L.C. = liquid chromatography~~
~~[b]NA = not applicable~~

~~C-2d FREQUENCY OF ANALYSIS~~

~~Sampling, as specified in Section C-2(C) and the corresponding analysis indicated in Section C-2(b), will be performed annually. Although historically only about six detonations are performed each year, this frequency was selected to ensure effectiveness of treatment and prevent storage of hazardous waste in the area.~~

~~**EXHIBIT C-1**~~

~~**SELECTION OF RANDOM SAMPLES**~~

~~**EXHIBIT C-1**~~

~~**SELECTION OF RANDOM SAMPLES**~~

~~The random number table included to this exhibit is used in the following manner:~~

~~1. The sampler proceeds to the row that corresponds to the month of the sampling event.~~

~~2 The sets of numbers are followed across the selected row until the sets that correspond with the date of the sampling event are reached.~~

~~3. The counting location within the grid selected by the preceding steps is selected by counting horizontally and vertically to the digit occupied by the last tow digits of the present year. For 1988, the starting location is identifies as the 8th column in the grid and the 8th row of the grid. Rows 1-5 are in the first set of digits and rows 6-10 are the second set of digits. For a sampling event on 10/14/88, the beginning number in the identified grid is "2".~~

~~4. Proceeding left to right, each set of two digits (i.e., 24, 88, 35, 33, 25,44, 01, 78, 03, ect.) are selected. Values larger than the sample population are discarded. For trench sampling with 30 cells, the locations would be grids 24, 25, and 01 If both residuals and soils are taken, the sample locations are grids 24, 25, and 01. Grids 03, 18, and 05 will be sampled for soils. If a value is repeated (i.e., 18, 18), the value is used only once.~~

~~The following table is from ASTM D140-70 and is used for selection of the required number of samples in dry unconsolidated materials. An example of grid numbering for both residuals and soils is provided on the following pages.~~

SECTION B

FACILITY DESCRIPTION

B-1 GENERAL DESCRIPTION

Holloman Air Force Base (AFB) is located on approximately 50,700 acres of land in Otero County of South-central New Mexico. The Facility lands are situated in the northern Chihuahuan Desert in the region known as the Tularosa Basin that is bounded to the east and west by the Sacramento and San Andres Mountains, respectively. The base is located adjacent to White Sands Missile Range and White Sands National Monument is located west ~~south~~ of the base. Regional water supplies are derived from Bonita Lake located approximately 60 miles north of the base and the Boles, Douglas, and San Andres Well Fields located 14 miles to the southeast.

The nearest population center is the city of Alamogordo located approximately 7 miles to the east. Regional metropolitan centers include El Paso, Texas, located 75 miles south-southwest and Albuquerque, New Mexico, located 210 miles north of the facility. The primary transportation route for the facility is Highway 70 that traverses the southern boundary of the base in a northeasterly direction. The general location of Holloman AFB is depicted in Figure B-1~~, volume 2~~.

Holloman AFB was initiated as a temporary facility developed to provide gunnery and bomber training to aircrews during World War II. The base mission was altered in the postwar years to the development of pilotless aircraft, guided missiles, and associated equipment. In the late 1950s the base was transferred to the Air Force Systems Command (AFSC) and designated as the Air Force Missile Development Center. On January 1, 1971 , the base mission expanded to provide lead-in fighter training for the 479th Tactical Training Wing and its components.

Figure B-1. General Location of Holloman Air Force Base

Currently, Holloman AFB hosts the Air Combat Command (ACC) 49th Fighter Wing, which includes pilot training, mobility support, and combat support operations. The primary Air Force Materiel Command (AFMC) component located at Holloman AFB is the ~~6586th~~ 46th Test Group, which is responsible for evaluation of propulsion and navigational systems for aircraft, space vehicles and missiles. A variety of tenant organizations are assigned to Holloman AFB including the 4th ~~Satellite~~ Space Warning Squadron, the New Mexico State University Primate Research Laboratory, ~~the 4th and 25th Weather Wing~~ and Det. 4, the 50th Weather Squadron. A general layout of the facility is provided in Figure B-2.

As a result of ACC readiness requirements and the 46th Test Group activities, a variety of ordnance, munitions, incendiaries, and propellants become waste because of exceedence of shelf-life, unanticipated deterioration, or failure to attain specifications that render the device non-serviceable. These waste explosives are considered characteristically hazardous under the Resource Conservation and Recovery Act (RCRA) due to reactivity (D003). Rocket motors that exceed 300 lbs are treated at the 20,000-Pound ~~Explosive Disposal~~ Open Detonation (20,000-Pound OD) Unit that is the subject of this permit. These units are regulated under 40 CFR 264, Subpart X, codified at 40 CFR 264.600 *et seq*.

~~The 20,000lb ED Area consists of a clear zone of a clear zone of approximately 1680 feet in diameter. A graded circular area of approximately 200 feet encircles the treatment pits and has an earthen berm that ranges from approximately 1 to 2 feet in height. A firebreak of approximately 6 feet in width encircles the entire area and also serves as a security road for the unit.~~

The 20,000-Pound OD Unit derives its name from the relevant operating procedures for this treatment activity. The net explosive weight (NEW) of solid propellant rocket motors that are simultaneously treated in the trench is limited to 20,000 lbs (i.e., 20,000 lbs per treatment event). This total does not include the mass of the

Figure B-2. Facility Layout of Holloman Air Force Base.

casings, other associated containment devices, and detonating charges. Although the precise number of treatment occurrences during any year is variable, discrete treatment events occur at typical frequencies of one event ~~every 2-3 months~~ per month. More specific information on ordnance constituents, ~~trench construction~~ the OD Unit, and operating procedures is provided in future sections.

~~The treatment zone is developed by excavation of two circular pits, approximately 20 feet apart, with approximate dimensions of 40 to 60 feet diameter and 10 feet in depth. Treatment of the wastes is accomplished by placement of the propellant item and C-4 charges into the deepest pit with the waste subsequently detonated. After completion of the detonation, the area is thoroughly inspected to ensure that the waste has been destroyed and to collect ejected residuals. Once inspection is completed, the pit is closed by backfilling with the original soil. The location of this unit and its surrounding area relative to the main base is provided in Figure B-3, Vol 2.~~

The 20,000-Pound OD Unit consists of a clear zone approximately 400 feet in diameter. Treatment of the wastes is accomplished by placing the explosive ordnance on top of the ground within a 100-ft diameter area at the center of the clear zone. The waste is then treated by detonation. The force of the explosion often creates a depression in the ground, which is inspected to ensure that the waste has been completely destroyed. Residuals ejected outside of the depression are collected and returned to the depression. Subsequent detonations are performed at locations surrounding the first depression within the 100-ft diameter detonation area. When the detonation area is covered with depressions, a bulldozer smooths out the site, filling in the depressions. The location of the OD Unit and its surrounding area relative to the main base is provided in Figure B-3 and B-4. A unit drawing of the area, showing dimensions of the unit, is provided in Figure B-5.

Figure B-3. Topographic Map of the 20,000-Pound OD Unit.

Figure B-4. Location of the 20,000-Pound OD Unit and Surrounding Landuse.

Figure B-5. Detailed Drawing of the 20,000-Pound Open Detonation Unit

(Figure forthcoming pending survey data from the Unit)

B-2 TOPOGRAPHIC MAP

The general requirements are met in a topographic map of the 20,000-Pound OD Unit and the surrounding area in Figure B-3. The provided topographic map indicates that the unit is located in relatively flat terrain; the OD Unit is also above the 100 year floodplain boundaries. No surface water of constant flow conditions is located in the area, although arroyos that contain runoff are located in the vicinity of the unit.

The topographic map delineates the area relief at intervals of 10 ~~25~~ ft.~~ the map scale of 1 inch equal to 400 feet is used in all Holloman AFB facility maps. Because of the cleared nature of the area and limited topographic relief, this topographic map delineates the area in the same detail as that provided by a scale of 1 inch equal to 200 feet.~~ Figure B-3 shows a large and small scale topographic map of the Unit. The large scale map is at a scale of one inch equal to 300 ft and shows topography in a 3000 by 2500-ft area around the Unit. The map is presented at that scale because all topographic contours are visible and a larger portion of the area surrounding the Unit can be seen. The small scale map shows the topography of the surrounding area and all hydrologic features in the vicinity of the unit.

B-2a SURROUNDING LAND USES

The 20,000-Pound OD Unit is located approximately 1000 ~~2600~~ ft within the northern boundary of Holloman AFB. White Sands Missile Range lies to the north and west of the adjacent base boundaries. All lands within Holloman AFB boundaries are under the control of the U.S. Air Force. Thus, the unit is surrounded by access-controlled Federal lands for a distance of several miles in all directions. Figure B-4 shows the land use immediately surrounding the OD Unit. The unit is situated on undeveloped grassland near areas of barren land (dunes) and arroyos and is isolated from commercial and residential landuses. The closest building on or off the Facility is approximately 4000 ft from the OD Unit. Figure B-3 show the distances to the nearest residential buildings (72,700 ft), public roadway (48,000 ft), and passenger railroad (85 miles).

B-2b UNIT BOUNDARIES

~~The unit boundary is designated in Figure B-4. This figure also delineates the clear zone surrounding the unit which extends to a radial distance of 8150 feet.~~ The unit drawing for the OD Unit, showing unit boundaries, is shown in Figure B-5. Holloman AFB facility boundaries are designated in Figures B-3 and B-4.

B-2c WIND ROSE

Wind roses are provided separately in Attachment E-1 ~~Exhibit E-6~~ for the five most recent years. Pertinent meteorological data, including wind dispersion modeling, are also provided in Section E-3.

B-2d ACCESS CONTROL

Access to the unit is provided by a single paved road that terminates at the entrance to the unit. Access is strictly controlled by Test Track safety personnel with radio contact with the Track Control Facility. All visitors and Holloman AFB personnel are required to check in at the Test Track Control Facility and the location of all vehicles is monitored in the northern portion of the Base. During detonation events access is not permitted.

B-2e INJECTION AND WITHDRAWAL WELLS

No injection or withdrawal wells are located within the unit's boundary or the adjacent area. ~~There are no wells located within the clear zone surrounding these munitions areas.~~ The location of groundwater wells within the boundaries of Holloman AFB and the location of wells in the areas adjacent to the base boundaries are discussed in Section E-1. Hydrogeologic data for Holloman AFB are also presented in Section E-1.

B-2f STRUCTURES

No buildings are located within the 20,000-Pound OD Unit. All nonordnance-related structures located within the clear zone are vacated prior to operations and cordoned off during the operations.

B-2g RECREATION ACCESS

No recreation areas are located in the vicinity of the 20,000-Pound OD Unit.

B-2h RUNOFF CONTROL SYSTEMS

Runon and runoff control systems are not present in the vicinity of the 20,000-Pound OD Unit. Such systems are unnecessary in the area of the unit due to limited precipitation received and the limited slope of the surrounding area.

B-2i ACCESS AND INTERNAL ROADS

The only access to the 20,000-Pound OD Unit is a paved ~~surface~~ road that terminates at the entrance to the unit. There are no roads inside the OD Unit boundaries.

B-2j STORM, SANITARY, AND PROCESS SEWERS

No storm sewers, sanitary, or process-related conveyances are located within the vicinity of the 20,000-Pound OD Unit.

B-2k LOADING AND UNLOADING AREA

Explosive ordnance is unloaded strictly at the ground location at the time designated for the treatment event. Explosive wastes are ~~generally~~ transferred directly from the transfer vehicle to the ~~pit~~ area on the ground where detonation will occur; no waste transfer or pickup stations exist. Procedures to prevent hazards during loading/unloading operations are addressed in Section F, “Procedures to Prevent Hazards”.

B-2l FIRE CONTROL FACILITIES

There are no fire control facilities at the 20,000 OD Unit. Immediate response fire control equipment, such as fire extinguishers and shovels, are brought to the unit

during operations. Base Fire Department capability is available to respond to emergencies should such an event occur. The fire department is notified 24 hours prior to thermal treatment events.

B-2m SURFACE WATERS

Surface water flows in the vicinity of Holloman AFB are generally intermittent in nature. The topographic map provided in Figure B-4 ~~indicates~~ shows the surface water features in the area. The boundaries for the 100-year and 500-year floodplains are not near the unit. Surface water flow patterns and draws that contain intermittent flow are further discussed in Section E-2.

B-2n FLOOD CONTROL/DRAINAGE BARRIERS

No structures for the control of flooding or drainage are present at the 20,000-Pound OD Unit. ~~An earthen berm of approximately 2 feet in height surrounds the entire treatment zone and provides some runon control~~. The unit is elevated sufficiently above the floodplain elevations that flooding potential is considered virtually nonexistent.

B-3 LOCATION INFORMATION

The 20,000-Pound OD Unit is exempt from seismic considerations because the unit is located in Otero County which is not among the political jurisdictions designated in Appendix VI, 40 CFR 265.

B-3a FLOODPLAIN STANDARD

The 20,000-Pound OD Unit is not located within the 100-year or 500-year floodplains of intermittent streams in the area. ~~The 100-year and 500-year floodplains are designated in the topographic map provided as Figure B-4.~~ Additional information related to surface drainage patterns is provided in Section E-2, “Surface Media Assessment”.

B-4 TRAFFIC INFORMATION

Access to the 20,000-Pound OD Unit is provided by a single paved road. A dirt road provides access from the paved road to the edge of the OD Unit ~~excavated pits~~. The detonation area is ~~pits are~~ approximately one quarter mile from the paved road.

Traffic along this route is restricted to official use of the EOD personnel during explosive operations, but may be accessed by Test Track personnel who are needed during operations.

As a result of these restrictions, the typical traffic volume and pattern consist of a maximum of several vehicles per day that are in transit to or from the unit. The precautions taken to ensure safe transport of the waste to the unit are described in Sections D and F.

B-4a ACCESS ROAD SURFACE

The single access road to the unit designated in Figure B-3 is a paved surface. This surface is periodically maintained to prevent formation of holes, ditches, or other deformation that would increase the possibility of accidental detonation during transport.

B-4b LOAD-BEARING CAPACITY

The paved service road was graded and compacted to provide capacity for automobiles, light trucks, heavy trucks, and service vehicles. The maximum amount of waste moved per vehicle movement along the paved surface road is 40,000 pounds. This total weight includes not only the net explosive weight but weight from inert casings, cannisters, etc.

~~SECTION E~~

~~ENVIRONMENTAL PERFORMANCE STANDARDS~~

~~E-1 SUBSURFACE ASSESSMENT~~

~~E-1a VOLUME AND CHARACTERISTICS OF THE WASTE~~

~~The types of wastes that have previously been treated in the 20,000lb ED Area were identified in Section C-1. These wastes may be summarized as:~~

~~° Pyrotechnics that contain an oxidant, fuel, priming charge, binder, and in some items colorant, retardant, or other additives.~~
~~° Propellant that consists primarily of nitrocellulose and nitroglycerin.~~
~~° Explosive devices that contain RDX, TNT, and trace quantities of detracting agents.~~

~~The total mass unit per treatment event is 20,000lb pounds of these waste devices. Each category of device will contain different quantities of energetic material. Therefore, the percentage of energetic material contained in the total mass unit varies. Pyrotechnic and propellant devices typically contain a larger percentage of energetic material per total mass than do explosive items. The percentage of energetic material in pyrotechnic devices is estimated to range from 40 to 80% of the total mass. It is estimated that propellant devices typically contain 50 to 60 % of the total mass as energetic material. On a mass basis, explosive devices contain smaller quantities of energetic material (40 to 50% of the total mass of the device). Thus, for any given treatment event the total quantity of energetic material may range from 8,000 to almost 10,000 pounds. The nature of the generating process (shelf-life exceedance, failure to detonate during use, etc.) prohibits strict specification of the total mass of the energetic material present in the 20,000lb ED Area for any discrete treatment event, although it is probable that the total energetic mass seldom exceeds 10,000 pounds. Thus, it is estimated that the average mass of energetic material treated in the 20,000 ED Area is approximately 50,000 pounds per year.~~

~~Although some potential exists for dinitrotoluene or hexachlorobenzene to enter the 20,000lb ED Area for treatment, these constituents do not meet the listing criteria for discarded commercial products or products in which the listed constituent is the sole active ingredient. Tetracene (a nitrosaminebased compound) and antimony sulfide meet only the NOS criteria for hazardous constituents and are not specifically listed. Under the conditions of the thermal treatment, the organic constituents are oxidized to CO, CO_2, N_2, NO_x, H_20, and possibly HX of hexachlorobenzene is present and are not expected to remain in the residuals. The posttreatment sampling protocols are designed to confirm the destruction of these constituents and ensure that these compounds are not present at the time of subunit closure. The potential for hexachlorobenzene as a constituent in the feed stream is very limited because this constituent has been largely replaced by PVC as both additive and colorant.~~

~~Thus, both the general nature of the treatment operation and sampling protocols ensure~~

~~that hazardous waste or constituents are not present at levels of concern. Analysis performed in 1983, shown in Table D-1, indicate that neither the soil, ash, or ordnance casing exhibit EP toxicity. Additional analysis performed during 1984 included the soil and residues from both the side and bottom of an active subunit. These results also indicate that residuals are not EP toxic and that contaminants have not migrated to underlying soils.~~

~~Thus, results submitted in a previous section indicate that historically the solid residuals that remain in the 20,000lb ED Area are nonhazardous in nature. The organic constituents of the initial charge are converted to gases during treatment. This distribution of gas products from treatment is indicated in Section E-3. During treatment, the oxidant portion of these energetic items (which is the primary potential source of EP toxic metals) is reduced to the elemental form or the oxide as indicated in Section C. For example, chromium (III) oxide, potentially present in thermite, is converted as elemental chromium during the reaction. Both the feed material and product are insoluble. Barium oxide, possibly present from the nitrate in the pyrotechnic devices, is soluble to the extent of approximately 3.5%. Lead oxide (possibly from pyrotechnics or detonators) is soluble to the limited extend of approximately 20 mg/L. Mercury oxides exhibit solubility similar to the oxides of lead. In general, detonators that are the primary potential source for lead or mercury are excluded in order to reduce the potential for detonation during treatment. Antimony oxide that may form from primer charges is only very slightly soluble (<15 mg/L). Solubility data for both the input constituents and certain other reaction by-products is provided in Tables C-5 and C-7.~~

~~E-1b HYDROGEOLOGIC CHARACTERIZATION~~

~~Holloman AFB is located in the southern part of the Tularosa Basin. The basin is approximately 120 miles long, bounded 8 miles to the east by the Sacramento Mountains and 20 miles to the west by the San Andreas Mountains. Elevations within the Tularosa Basin range from 4400 feet above mean seal level (MSL) at the northeast corner to 4000 feet MSL in the southwest corner. Elevations at the base range from 4100 to 4028 feet MSL.~~

~~Geologically, the Tularosa Basin is a graben structure, bounded on the east and west by mountains which are actually tilted fault blocks (CH$_2$M Hill, 1988). The base is underlaid by unconsolidated bolson deposits (sediments carried by water into the closed basin) more than 4000 feet thick in the vicinity of Holloman AFB. Figure E-1 illustrates a general east-west geologic cross section in the vicinity of Holloman AFB. Only the uppermost bolson deposits are of significance to this permit application.~~

~~Figure E-3 illustrates the relationship between the Sacramento Mountains and the bolson fill in relation to groundwater occurrence. At the base of the mountains, the hydraulic gradient is quite steep but then flattens out quickly. In the vicinity of Holloman AFB, the ground surface slopes gently to the southwest, but at a slightly higher rate than the water table. Depth to water table at the well fields near the mountains is 270 feet or more below land surface (BLS), while at Holloman AFB the water table is 5 to 10 feet BLS. Figure E-3 and E-4 illustrate the configuration of the water table. Like surface drainage, groundwater flows to the southwest, discharging by evapotranspiration.~~

~~The bolson fill is derived from soluble rocks such as limestone, dolomite, and particularly gypsum, of the surrounding mountains. Fresh water recharges the fill at the base of the mountains. Since the bolson fill consists of highly soluble materials, groundwater dissolves formation minerals and water quality degrades with increased contact time. In fact, the only fresh groundwater in the vicinity is near the source recharge.~~

~~Results of boring and slug and pump test, conducted from July through November 1987 (Radian corporation, 1988) at Holloman's sewage treatment lagoons, describe the shallow aquifer as being composed of saturated sands, silts, and clays hydraulically interconnected. Discontinuous clays separate coarsegrained, shallow water-bearing sand and silt units from deeper units of equal or greater grain size. The bolson fill aquifer exists under water table conditions in the first saturated shallow zone. With increasing depth, successive clay and silt units created semiconfining conditions. Artesian conditions do not exist at the shallow depths that were investigated. A comparison of transmissivity, hydraulic conductivity , and storage coefficient calculations in the slug tests and pump test yielded values that would be expected in highly stratified inhomogeneous basin fill sediments (see Section E-1d).~~

~~E-1b(1) DEPTH TO UPPERMOST AQUIFER~~

~~Depth to the water table at well fields near the Sacramento Mountains is 270 feet or more BLS. At Holloman AFB, the water table is 5 to 10 feet BLS.~~

~~E-1b(2) ESTIMATED ANNUAL RECHARGE~~

~~The annual precipitation at Holloman AFB averages 7.9 inches, with annual extremes from 2.5 inches to 13.5 inches. The mean annual lake evaporation rate, commonly used to estimate the mean annual evapotranspiration rate, averages an estimate 67 inches per year. The annual net precipitation for the area is approximately -59 inches per year.~~

~~E-1b(3) SUBSURFACE CHARACTERIZATION~~

~~Most of the base is covered with well-drained soils (fine sandy loam) formed in typsiferous sediments of eolian (wind blown) or alluvial orgin (CH$_2$M Hill, 1983). These soils comprise the Holloman-Gypsum land Yesum complex. The soils are thin and overlie discontinuous beds of gypsum. Below is a typical soil profile as described by the U.S. Department of Agriculture Soil Conservation Service:~~

~~**A. Horizon** - to 3 inches: very pale brown very fine sandy loam, pale brown moist: Weak medium and coarse granular structure: soft, very friable, nonsticky and nonplastic, very few very fine and fine roots: common very fine and fine interstitial pores; strongly calcareous: moderately alkaline: clear smooth boundary.~~

~~**C1 Horizon** - 3 to 13 inches: very pale brown very fine sandy loam, brown moist: massive; soft, very friable, slightly sticky and nonplastic very few fine and medium roots; common fine and very fine interstitial pores: strongly calcareous; moderately alkaline; clear smooth boundary.~~

~~**C2 Horizon** - 12 to 20 inches: very pale brown gypsum, pale brown moist; massive; soft, very friable, slightly sticky and nonplastic; very few fine and medium roots; few fine and common very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.~~

~~**C3 Horizon** - 20 to 60 inches: white gypsum, pale brown moist: massive: slightly hard. very friable, slightly sticky and slightly plastic: common fine and very fine interstitial pores; strongly calcareous; moderately alkaline.~~

~~Figure E-2 shows a geologic cross section of the bolson fill deposits in the vicinity of Holloman AFB. The shallow bolson deposits are Miocene to Pleistocene alluvial, clays, sands, and gravels. The sediments are highly stratified. The basal contact of the bolson is estimated to be the top of permian bedrock (depth unknown).~~

~~Lithologies encountered during subsurface investigations at Holloman's wastewater treatment lagoons consists of a thin layer (approximately 3 to 11 feet thick) of dry silt and/or sand underlaid by saturated sand or sand and silt layer. The shallow and layer is usually underlaid by a thin clay layer (approximately 2 to 7 feet thick) or interbedded sand, silt, and clay. A second saturated zone consisting of sand, silt, and clay underlies this clay layer. This saturated zone ranges in thickness from approximately 34 to about 50 feet. At these depths, some holes were completed in a green clay layer and some hoses were completed while still in the saturated zone.~~

~~E-1c EXISTING GROUNDWATER QUALITY~~

~~Groundwater throughout the Holloman AFB area is naturally high in total dissolved solids (TDS). Field samples taken during an investigation of Holloman's sewage treatment lagoons (Radian Corporation, 1988) revealed TDS levels that exceeded 10,000 mg/L, making the water saline (10,000 to 100,000 mg/L). These TDS levels are attributable primarily to sulfates and chlorides. There has been no sampling for waste constituents specific to the ED unit.~~

~~E-1d GROUNDWATER DIRECTION AND FLOW RATE~~

~~Water enters the bolson fill aquifer at the edge of the Tularosa Basin and moves downgradient to the southwest. Groundwater discharges by evapotranspiration in the basin's interior near the White Sands National Monument.~~

~~Flow rates in the shallow bolson fill aquifer are general low due to the low hydraulic gradient and moderately low permeability of sediments. Calculated groundwater velocities using information derived from slug tests performed in nine piezometers at Holloman's wastewater treatment lagoons (Radian Corporation, 1988) ranged from 0.003 to 0.13 feet per day. Table E-1 shows groundwater velocities based upon the results of the slug tests. The average hydraulic conductivity of 9 piezometers tested was 46 gallons per day per square foot. The average transmissivity value was 210 gallons per day per square foot. Transmissivity, storage coefficient, and hydraulic conductivity data from pump tests (Radian Corporation, 1988) are shown in Table E-2.~~

~~E-1e PROXIMITY TO GROUNDWATER WITHDRAWAL POINTS~~

~~No water supply wells are located on Holloman AFB because of the poor quality of groundwater (Radian Corporation, 1988). Base potable water supplies are obtained from Bonita Lake and from 21 wells in three separate well fields located on the western slope of the Sacramento Mountains approximately 10 miles east of Holloman AFB. Production wells in that area intercept groundwater at depths ranging from 250 to 300 feet BLS (CH_2M Hill, 1983).~~

~~E-1f POTENTIAL IMPACTS ON HUMAN HEALTH~~

~~This information is not required for this permit application because the uppermost aquifer (or hydraulically connected aquifers) is not used for drinking water supply. Because groundwater below Holloman AFB contains high TDS (in excess of 10,000 mg/L), the groundwater is designated as unfit for human consumption based upon New Mexico Water quality Control Regulations (Radian Corporation, l988.~~

~~Table E-1. Horizontal Groundwater Velocity Results from Nine Slug Tests, Holloman AFB, New Mexico~~

~~Well Number~~	~~Total Depth (ft. below surface~~	~~Hydraulic Conductivity (gpd/ft^2)~~	~~Porosity[b] (%)~~	~~Velocity[c] (ft/day~~	~~(ft/year)~~
~~S-2~~	~~24.75~~	~~7.1~~	~~40~~	~~0.007~~	~~2.6~~
~~S-4~~	~~20.00~~	~~85.6~~	~~30~~	~~0.13~~	~~47.5~~
~~S-5~~	~~17.00~~	~~61.8~~	~~40~~	~~0.07~~	~~25.6~~
~~S-8~~	~~22.00~~	~~56.2~~	~~50~~	~~0.05~~	~~18.3~~
~~S-11~~	~~19.00~~	~~80.2~~	~~30~~	~~0.12~~	~~43.8~~
~~S-15~~	~~15.00~~	~~69.9~~	~~30~~	~~0.11~~	~~40.2~~
~~S-16~~	~~34.00~~	~~45.8~~	~~40~~	~~0.05~~	~~18.3~~
~~D-2~~	~~77.00~~	~~2.8~~	~~40~~	~~0.003~~	~~1.1~~
~~D-5~~	~~64.70~~	~~3.1~~	~~30~~	~~0.004~~	~~1.5~~
~~Average~~		~~45.8~~	~~36.7~~	~~0.06~~	~~21.0~~

~~**a** Modified from Radian Corporation, 1988.~~

~~**b** Based on the following values for porosity: sand= 30%; silt =40%; clay = 50%.~~

~~**c** Velocity (v) =~~ $\frac{K(dh/dl)}{7.5a}$

~~Table E-2. Transmissivity, Storage Coefficient, and Hydraulic Conductivity Data and Pump Tests~~[a]

~~Well ID~~	~~Total ft below surface~~	~~Transmissivity (gpd[b]/ft)[2]~~	~~Storage Coefficient~~	~~Hydraulic Conductivity (gpd/ft[2])~~
~~P-1~~	~~77.00~~	~~126~~	~~NR[c]~~	~~12.6~~
~~D-3~~	~~75.00~~	~~377~~	~~0.00005~~	~~37.7~~
~~S-12~~	~~12.00~~	~~ND[d]~~	~~ND~~	~~ND~~
~~P-2~~	~~12.00~~	~~106~~	~~NR~~	~~10.6~~
~~S-13~~	~~20.00~~	~~ND~~	~~ND~~	~~ND~~
~~S-14~~	~~35.00~~	~~ND~~	~~ND~~	~~ND~~
~~D-4~~	~~58.00~~	~~330~~	~~0.0002~~	~~33~~

~~**a**. Modified from Radian Corporation, 1988.~~
~~**b**. gpd = gallons per day~~
~~**c**. NR = Not Reported. Jacob straight-line method and Theis curve-matching technique unacceptable due to pump-well interference.~~
~~**d**. ND = Not determined. Drawdown. Drawdown response was sufficient or too sporadic to plot T and S values.~~

~~E-lg POTENTIAL IMPACTS ON SUBSURFACE PHYSICAL STRUCTURES AND FOOD CHAIN CROPS~~

~~This information is not required because there are no downgradient or near base irrigation wells (Radian Corporation, 1988). Also, corrosive wastes are not generated at the OB unit and there are no physical structures present that may be affected by potential corrosive wastes migrating with groundwater.~~

~~E-1h POTENTIAL IMPACTS ON WILDLIFE, DOMESTIC ANIMALS, AND VEGETATION~~

~~Because of the high negative rate of not yearly precipitation (approximately -59 inches) and the unsuitability of the shallow aquifer as a drinking of irrigation water source, this information is not required for this permit application.~~

~~E-1i LAND USE PATTERNS~~

~~Real property records indicate land used for the ED unit consists of leased acreage within the boundary of Holloman AFB. Recommended land use restrictions fro the site (CH^{2}M Hill, 1983) include restrictions on the following:~~

- ~~recreational use,~~
- ~~well construction on or near the site,~~
- ~~housing on or near the site,~~
- ~~agricultural use,~~
- ~~surface water impoundments,~~
- ~~construction,~~
- ~~excavation,~~
- ~~unnecessary burning operations or ignition sources,~~
- ~~vehicular traffic, and~~
- ~~site access.~~

~~E-1j ASSESSMENT OF GROUNDWATER MIGRATION POTENTIAL~~

~~The potential for groundwater contamination at Holloman AFB is high, in general, due to the high groundwater table (10 to 15 feet BLS). This potential is reduced somewhat by the low driving force for vertical contaminant migration (CH^{2}M Hill, 1983). Contaminants entering the groundwater would move very slowly (due to the low hydraulic gradient and moderately low permeability) to the southwest, towards the White Sands National Monument.~~

~~Groundwater at Holloman AFB exceeds 10,000 mg/L TDS making it unusable as a domestic or agricultural water supply source. The nearest downgradient potable supply well is approximately 20 miles west of the base (Radian Corporation, 1988). The nearest livestock well is 3.5 miles to the southwest.~~

~~E-2 SURFACE MEDIA ASSESSMENT~~

~~This section reviews the 11 factors that must be considered in the assessment of impacts upon surface media. Surface media refers to surface waters and the soil surface. Data that have previously been provided are only referenced.~~

~~E-2a VOLUME AND CHARACTERISTICS OF THE WASTE~~

~~The hazardous characteristics, chemical functionalities, physical characteristics, and annual quantities of waste to be treated at these units were previously described in Sections E-1a and C-1. Solubility data presented in Sections C, D, and E-1a are also relevant to the surface media assessment.~~

~~E-2b CONTAINMENT FACILITIES~~

~~Sections D-2 and D-4 describe preventative measures for migration of waste or waste constituents from the unit. These elements include the pit sidewalls and the earth berm around the clear zone. These elements restrict ejection of waste residuals during treatment events, ensure residuals are retained in the treatment zone, and restrict runon into or runoff from the unit. Additionally, as described in Section D, the area surrounding the detonation zone is graded to divert runon from entering the unit. Thus, the containment design restricts migration to the mechanisms of detonation-related ejection of waste from the unit, and limited quantities of contaminated runon/runoff that escape. Treatment of waste is not performed during precipitation events, if such events are predicted to occur within the 48 hour time frame surrounding the treatment, or if such an event appears imminent.~~

~~E-2c HYDROLOGICAL CHARACTERISTICS~~

~~Data on surface soils and topsoils surrounding these units were discussed in Section E-1. Most of the base is covered with well drained soils (fine sandy loam) formed in gypsiferous sediments of eolian (wind blown) or alluvial (stream deposition) origin. The soils are thin and overlie discontinuous beds of gypsum. The soils are nearly level with slopes ranging from 0 to 5%. A typical soil profile, as described by the US Department of Agriculture, Soil Conservation Service, follows:~~

~~A Horizon~~ ~~- 0 to 3 inches: very pale brown very fine sandy loam, pale brown moist; weak medium and coarse granular structure; soft, very friable, non-sticky and nonplastic; very few very fine and fine roots; common very fine and fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.~~

~~C1 Horizon~~ ~~- 3 to 13 inches: very pale brown very fine sandy loam, brown moist; massive; soft, very friable, slightly stick and nonplastic very few fine and medium roots; common fine and very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.~~

~~C2 Horizon~~ ~~- 12 to 20 inches: very pale brown gypsum, pale brown moist; massive; soft, very friable, slightly sticky and nonplastic; very few fine and medium roots; few fine and common very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.~~

~~**C3 Horizon** - 20 to 60 inches: white gypsum, pale brown moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine interstitial pores; strongly calcareous; moderately alkaline.~~

~~Surface water resources within the Tularosa Basin are limited by the high evaportranspiration rate and low annual rainfall. Surface water is either lost to evaporation and infiltration or collects in the lowest point in the basin at or near Lake Lucero, located at the southwest edge of the gypsum dune field west of the base. Surface water within the basin makes its way to Lake Lucero. Here, also a discharge point for groundwater, sulfate salts are concentrated by evaporation. The prevailing southwest winds than pick up and transport the salts, primarily gypsum, in a northeasterly direction to continue building the dune field of the White Sands National Monument.~~

~~The base is crossed by several southwest trending "arroyos" or intermittent stream beds including Lost River (the largest), Dillard Draw, and several smaller tributaries such as Red Arroyo and Arroyo Cavacita. Lost River is fed by groundwater seeps or springs. The river appears and disappears along its course as springs add water and evapotranspiration and infiltration recapture it.~~

~~The intermittent streams and arroyos occurring within the basin are important drainage features only during the infrequent heavy rainfall, conveying surface water southwest to the basin's lowest elevation point.~~

~~Surface drainage within the undeveloped parts of the base is controlled by the major arroyos including Lost River, Dillard Draw, and their tributaries. Surface flows are directed southwest toward the White Sands National Monument. Lost River at one time discharged into White Sands National Monument after traversing the base. Lost River has now been dammed on the base just east of the property boundary. This was done to ensure that base storm drainage would not enter the National Monument.~~

~~Drainage within the developed portion of the base flows by way of ditches and culverts to the southwest corner of the base in the vicinity of the wastewater treatment lagoons. Figure E-5 illustrates base topography and drainage patterns.~~

~~E-2d PRECIPITATION PATTERNS~~

~~A tabular monthly summary for precipitation received at Holloman AFB over the preceding 44 years is provided as Table E-3.~~

~~E-2e GROUNDWATER DATA~~

~~Depth to the uppermost aquifer is discussed in Section E-1. These data are derived from soil corings taken in the vicinity of the Holloman AFB sewage treatment lagoons. A general hydrogeologic description of the soil stratigraphy for the unsaturated zone, saturated zone, and confining layer is also provided. Groundwater quality data is presented in Section E-1.~~

~~E-2f PROXIMITY TO SURFACE WATERS~~

~~No continual surface water flow is present in the vicinity of these units. The intermittent flows that occur in Dillard Draw or the Lost River are separated from these units by a considerable distance. All of the thermal treatment units at Holloman AFB are located above the 100-year floodplain elevation.~~

~~E-2g WATER QUALITY STANDARDS AND USE~~

~~No water quality standards apply to the intermittent surface flows present at Holloman AFB. The only continual bodies of water present on the base are the sewage treatment lagoons located in the southwest portion of the base.~~

~~E-2h WATER QUALITY DATA~~

~~Water quality data are not applicable to the intermittent stream flows that result from precipitation events.~~

~~E-2i LAND USE PATTERNS~~

~~Local land use designations for the areas surrounding these units are discussed in section E-1i. A land ownership map for the immediate vicinity is provided as Figure B-5 (in back pocket). No industrial development zones are located near Holloman AFB. Any contaminant migration to surface waters would, therefore, not impact industrial development.~~

~~E-2j IMPACTS ON HUMAN HEALTH~~

~~Impacts to human health that may be caused by migration of waste or waste constituents are expected to be limited in scope. The intermittent waters of Holloman AFB are not withdrawn for drinking water or industrial use. Volatilization of any organic contaminant is not expected as these contaminants will be converted largely to gas form during treatment.~~

~~The more possible impact to human health would occur from contaminated runoff entering one of the intermittent streams. However, the potential for this form of migration is exceptionally limited by the low rainfall and high evaporation rates of the area. Additionally, with the exception of ejected fragments, the residuals from treatment events are contained below surface level. The units used for treatment are treated in areas of limited relief.~~

~~E-2k POTENTIAL IMPACTS ON WILDLIFE, DOMESTIC ANIMALS, AND VEGETATION~~

~~No livestock operations are conducted within the ED area or surrounding area. Livestock grazing may occur sporadically approximately 0.5 miles east of the 20,000 ED Area, but no impacts that result from surface-water-carried migration can be envisioned that would affect this operation because it is not traversed by waters local to the unit. No horticultural or silvicultural operations are located in the vicinity of the reservation.~~

~~If migration of waste or hazardous constituents occurred by surface water transport, some exceedingly limited impact upon these species may occur through use of nearby waters as a drinking source or from surface contact.~~

~~The only threatened or endangered species that occurs on Holloman AFB is the White Sands Pupfish that resides in the brackish pools of the lower Lost River. The species is a group of two species as classified by the State of New Mexico, but is not listed by the U.S. Fish and Wildlife Service. Because of the distance of these waters from the units, no impacts can be envisioned.~~

~~E-2l ASSESSMENT OF SURFACE WATER MIGRATION POTENTIAL~~

~~Assessment of the factors presented in this section indicates that the potential for migration of waste or hazardous constituents by surface water transport is limited . Contaminant transport to surface soils or surface waters adjacent to the 20,000lb ED Area is limited to deposition of particulates ejected during detonation. The limited quantity and wide-area dispersion of the deposited contaminants would limit any impact to minimal effects. Although some "hot spots" may result through this deposition, the potential for their formation is limited and the size of such localized contamination would be very small. Additionally, posttreatment inspections to collect fragments will reduce the potential for this type of transport. Furthermore, because of the arid climate, runoff contamination from any such localized zones would be of limited duration. Only hazardous metal constituents would be expected to exhibit appreciable environmental half-lives and the soil samples are screened for those constituents. Additionally, the general operational characteristics in which the unit is regularly covered further reduces runoff based transport.~~

~~E-3 AIR ASSESSMENT~~

~~E-3a VOLUME AND CHARACTERISTICS OF THE WASTE~~

~~Refer to Section E-1a for a discussion of waste volume and characteristics.~~

~~E-3b REDUCTION OR PREVENTION OF EMISSIONS~~

~~There are no structures or control systems designed to prevent or reduce emissions of hazardous constituents to the air.~~

~~E-3c OPERATING CHARACTERISTICS~~

~~The ED unit at Holloman AFB is currently operated on an intermittent basis for treatment of waste energetic items. Nearly all of the energetic materials are transformed into gaseous or particulate form. Operating procedures for both subunits were presented in Section D. The time required for the detonation process consists of two components which include the following:~~

- ~~waste placement and stacking (1 to 8 hours),~~

~~° detonation inspection (1 hour)~~

~~The emissions associated with the process are nearly instantaneous due to the nature of the treatment process. Total emissions and analysis of potential receptor exposures are presented for typical treatment cases in Section E-3f.~~

~~E-3d ATMOSPHERIC, METEOROLOGICAL, AND TOPOGRAPHIC CHARACTERISTICS~~

~~The 20,00lb ED Area at Holloman AFB is situated on flat terrain. There are no complex topographic features in the vicinity. The meteorologic conditions on-site were previously presented in Table E-3. Additionally, wind roses for the last four quarters are summarized in Figure E-6. (Vol 2, page 10)~~

~~E-3e EXISTING AIR QUALITY~~

~~Otero County, NM, is identifies as an attainment area for all National Ambient Air Quality Standards (NAAQS). Holloman AFB emits none of the NESHAP parameters other than benzene, toluene, and xylene from fueling of aircraft. Table E-4 summarizes state and federal NAAQS and PSD increments.~~

~~E-3f ASSESSMENT OF AIR MIGRATION POTENTIAL~~

~~In order to assess the potential for contaminant migration via the air medium, the types and quantities of emissions must be identified for treatment methods as applied to the routine waste streams. A search of available literature reveals that there is some data in regard to detonation products of explosive materials but a scarcity of information on detonation explosives. the following discussion on detonation emissions is excerpted from AP-42, EPA.~~

~~"The emissions from explosives detonation are influenced by many factors such as explosive composition, product expansion, method of priming , length of charge, and confinement. These factors are difficult to measure and control in the field and are almost impossible to duplicate in a laboratory test facility. With the exception of a few studies in underground mines, most studies have been performed in laboratory test chambers that differ substantially from the actual environment. These approximations cannot be made more precise because explosives are not used in a precise, reproducible manner.~~

~~Carbon monoxide is the pollutant produced in greatest quantity from explosives detonation. TNT, an oxygen deficient explosive, produces more CO than most dynamites, which are oxygen balanced. But all explosives produce measurable amounts of CO, Particulates are produced as well, but such large quantities of particulate are generated in the shattering of the rock and earth by the explosive that the quantity of particulates from the explosive charge cannot be distinguished. Nitrogen oxides (both NO and NO_2) are formed, but only limited data are available on these emissions. Oxygen deficient explosives are said to produce little or no nitrogen oxides, but there is only a small body of data to confirm this. Unburned hydrocarbons also result from explosions, but in most instances, methane is the only species that has been~~

~~reported."~~

~~A literature search was performed to identify the relative concentrations of CO, NO_x, CO_2, HX, and P_4O_{10} that result from the thermal treatment of propellants, explosives, and pyrotechnics that contain $TlCl_4$ and phosphorus. Some limited data on the detonation of propellants and explosives was found. Emissions data from detonation of nitrocellulose/nitroglycerin (NC/NG) propellant mixtures, TNT, and RDX were found in the literature. Limited data from burning of NC/NG propellant and TNT were also found.~~

~~The limited data available were used to formulate mean balance emissions for anticipated worst-case scenarios. The assumptions utilized in these calculations were:~~
~~**(1)** Alkyl nitrate energetics behave in a manner similar to NC/NG.~~

~~**(2)** Aryl nitrate energetics behave similarly to TNT and/or RDX.~~

~~**(3)** Propellant mixtures contain approximately 50% energetic material as a percentage of the total mass.~~

~~**(4)** Pyrotechnics contain approximately 75% of the total mass as the energetic material.~~

~~Based on these assumptions and extrapolation of the literature data, worst-case scenarios were developed in order to project emissions. A summation of the cases is presented below.~~

~~**Case 1:** Assumes detonation of 20,000 pounds of rocket motors containing 10,000 pounds of NC/NG propellant. A carbon monoxide yield of 1000 pounds was calculated: NO_x emissions were negligible.~~

~~**Case 2:** Assumes open burning of 250 pounds of 33% propellant and 66% mixed aryl nitrate explosives. This scenario yields the largest CO and NX_x values. The CO yield was calculated as 8.3216 and NO_x was estimated at 9.15 pounds. The mixture was assumed to be 25% energetic material.~~

~~**Case 3:** Assumes OB of 250 pounds of phosphorus based charges and incindiary devices considered to be 75% energetic material (including $T1C1_4$). The yields for this scenario were P_40_{10} (388 pounds) HC1 (46.9 pounds), and TSP (41.3 pounds).~~

~~**Case 4** Assumes OB of 250 pounds containing hexachlorobenzene pt-12% to be 75% energetic material. The thermal NO_x yield was 5.6 pounds and the HC1 yield was 20.6 pounds.~~

~~**Case 5:** Assumes OB of 250 Pounds of NC/NG considered to be 100% energetic. The NO_x yield was 50 pounds and the CO yield was 87.5 pounds.~~

~~The mass balance basis used for calculations is presented as a fraction of pounds of charge in Tables E-5. Values for burning of pyrotechnics are based strictly on mass balance of theoretical combustions.~~

~~The worst-case values were used as input values for the PUFF model 13 and the outputs are provided as Exhibit E-2.~~

~~The output from the model indicated that detonation of these large masses will exceed the NAAQS at distances of 0.5 km, but that the concentration was approximately 50% of the NAAQS value (40 mg/m^3) at a distance of 1.0 km. This was the only scenario that violated any criteria pollutant NAAQS.~~

~~TABLE E-5. PROJECTED EMISSIONS FROM EXPLOSIVES DETONATION~~

	~~ESTIMATED EMISSIONS RATE (POUNDS PER POUND CHARGE)~~				
~~Charge~~	~~N_2~~	~~NO_x~~	~~CO~~	~~CO_2~~	~~H_2O~~
~~RDX,HMX~~	~~0.38~~	~~NEG[a]~~	~~0.25~~	~~0.20~~	~~0.01~~
~~Propellant Mix~~	~~0.19~~	~~NEG~~	~~0.10~~	~~0.56~~	~~0.12~~
~~TNT, Cyclotol~~	~~0.10~~	~~Neg~~	~~0.60~~	~~0.50~~	~~0.25~~

~~[a] Neg - negligible~~

~~EXHIBIT E-1~~

~~DESCRIPTION OF PUFF MODEL AND OUTPUT~~

~~FOR WORST-CASE EMISSIONS~~

~~**E.** Description of Puff Release~~

~~The dispersion of a puff can be described in Gaussian terms just as the continuous release. In a continuous model the plume disperses in the vertical (z) and horizontal cross wind (y) direction. In a puff model the dispersion takes place in the z, y, and downwind (x) direction. The calculated concentration is the peak instantaneous concentration and it is independent of wind speed.~~

~~When a release occurs the gas forms a spherically-shaped cloud just above the point of release. The concentration in the cloud is highest at the center. The cloud then is transported by the wind growing in size as it entrains ambient air. The growth of the cloud and its movement can be compared to a balloon that gradually inflates as it is moved by the wind. The mass of the gas in the cloud does not change as the cloud moves downwind, but its concentration does, as more ambient air is entrained.~~

~~Sometimes the release is not instantaneous but takes place over a period of several minutes such as when gas in a cylinder leaks out or during the interval between the time a leak in a valve is discovered and it can be stopped. In cases such as these the cloud may become somewhat elongated and look like a blimp or a hot dog. By assuming an instantaneous release a puff model will overestimate peak concentrations, but it will have virtually no effect on average concentrations provided the average concentrations provided the averaging time is long enough.~~

~~**F.** Puff Model dispersion Coefficients~~

~~The EPA puff model uses dispersion coefficients developed by studying instantaneous release.[6] These coefficients generally provide for less plume dilution than the familiar Pasquill-Gifford coefficients. The table show the dispersion coefficients. Figures 10 and 11 plot the coefficients on a diagram of the Pasquill-Gifford coefficients.~~

~~Coefficient = ax^b where x is downwind distance in meters~~

	Horizontal (x and Y)		Vertical (z)	
Stability	a	b	a	b
Unstable	.14	.92	.53	.73
Neutral	.06	.92	.15	.70
Very Stable	.02	.89	.05	.61

~~Since the dispersion in the x and y direction are generally considered to be equal, some authors refer to the standard deviation in the horizontal as σ_r (r for radius).~~

~~**G.** Average Concentrations from Puff Release~~

~~Average Concentration is a function of wind speed. For example, a wind of 10 knots~~

~~will transport twice as much air past a site as wind of 5 knots. The average concentration is a function of the number of standard deviations in the horizontal direction (sigma-x or sigma-r) that pass a given point for the averaging time in questions. At long downwind distances and low wind speeds the average concentration will not be much less than the peak instantaneous concentration. The puff has become so dilute that possibly less than one sigma passes a point for the averaging time specified.~~

~~At the other extreme, there is a significant difference between average and peak instantaneous close to the release point. This is because the puff is small in dimension and most of the material passing a point is air except for the very concentrated puff. Figure 12 illustrates how a puff would disperse from a pipeline break.~~

H. Puff Equations

The basic equation is :

$$x_f = \frac{Q_m}{(2\pi)^{1.5}\sigma_x\sigma_y\sigma_z} \exp\left\{-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right\} \left\{\exp\left\{-\frac{1}{2}\left(\frac{H+z}{\sigma_z}\right)\right\} + \exp\left\{-\frac{1}{2}\left(\frac{H-z}{\sigma_z}\right)^2\right\}\right\}$$

Note that Q is a release quantity in this equation, not a release rate. X_f is a peak instantaneous concentration, not the average concentration.

x_f = peak instantaneous concentration (grams per cubic meter)

Q_m = Source strength (grams)

π = 3.1416

σ_x = horizontal downwind dispersion coefficient (meters) (This value is often set equal to σ_y)

σ_y = horizontal crosswind dispersion coefficient (meters)

σ_z = vertical dispersion coefficient (meters)

H = effective stack height (meters)

I. When to use Puff or Continuous Release Models

The puff model should be used when the release interval of the cloud is less than the travel time of the cloud. For example, if the release took place over a period of 10 minutes, then it would be appropriate to calculate concentrations at receptors beyond a 10-minute travel time distance it would be appropriate to use a puff 14 model based on the release of a series of puffs at intervals of, say, one minute or use a continuous release model such as PAL or ISCST.

 For receptors within a 10 minute travel time distance it would be appropriate to use a puff model.

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Attachment G-1

OD Unit Contingency Plan

This plan outlines the procedures for responding to an emergency at Holloman AFB which involves hazardous waste at the OD Unit.

General Information

This Contingency Plan is designed to minimize hazards to human health and the environment from emergencies that may occur as a result of managing hazardous wastes (ordnance materials) at the Holloman AFB 20,000-Pound OD Unit. The ordnance materials are solids which demonstrate the hazardous characteristic of reactivity. Emergency events that could occur would be an uncontrolled explosion, a fire, or a diesel fuel spill.

This Contingency Plan will be reviewed and, if necessary, amended whenever any of the following occurs:

- The facility permit is revised;
- The plan fails in an emergency;
- Design or operation of the facility changes significantly such that implementation of the Contingency Plan would be affected;
- List of emergency coordinators changes; or
- List of emergency equipment changes.

Activities at the OD Unit consist of detonation of ordnance materials which are considered to be hazardous wastes due to their exhibiting the characteristic of reactivity (EPA Hazardous Waste Code D003). As evidenced by the chemical composition information contained in the Waste Characteristics section (Section C), the ordnance materials contain relatively few hazardous constituents that would persist after detonation and the constituents are relatively immobile. Consequently, the only immediate threat to

human health or the environment as a result of activities at the OD Unit is an uncontrolled explosion, a fire, or a diesel fuel spill.

The primary mission of the OD Unit is to render safe reactant materials at Holloman AFB that have exceeded their shelflife, deteriorated unexpectedly, or failed to attain specifications. In the event that an uncontrolled explosion occurred at the OD Unit, the exploded materials would not present a danger to human health or the environment outside the immediate area of the OD Unit. In that event, additional EOD personnel would be dispatched to the OD Unit to render safe any unexploded ordnance material that may be present following an uncontrolled explosion.

There is a fire response station located at Holloman AFB. Fires that occur at Holloman AFB are handled by Fire Protection Flight at Holloman AFB. Additionally, Holloman AFB maintains a Disaster Control Group which can also respond to fire emergencies. For fire emergencies that are extremely large, Holloman AFB has agreements with the cities of Alamogordo, Cloudcroft, and Alamo West to use their volunteer fire departments.

In the event of a diesel fuel spill, Fire Department personnel will respond. EOD personnel maintain additional spill response equipment and are trained in diesel fuel spill response.

The overall approach for emergency response at Holloman AFB is through a hierarchy of personnel for responding to emergencies throughout the Base as detailed in Holloman AFB's Base Civil Engineer Contingency Response Plan. The procedures outlined in this Contingency Plan are developed to specifically detail the procedures for an emergency involving hazardous waste at the OD Unit.

Copies of this plan, as well as updates, are kept with the primary and secondary emergency coordinators as well as with the on-post police, fire department, and hospital (49th Fighter Wing Hospital).

Emergency Coordinators

The primary Emergency Coordinator at Holloman AFB is the Commander of the 49th Support Group. The Commander has a detailed knowledge of: hazardous waste operations at Holloman AFB; layout and operations at the OD Unit; and the emergency response procedures of the Contingency Plan and the Spill Prevention and Response Plan. The Emergency Coordinator has the authorization to commit all resources necessary for emergency response activities. Either the Emergency Coordinator or the secondary Emergency Coordinator is on-site or on-call at all times. The Commander's on-base extension is 5541.

The secondary emergency coordinator at Holloman AFB is the Base Civil Engineer. The on-base extension for the Base Civil Engineer is 3071. In addition to these two emergency coordinators, Holloman AFB has Environmental and Engineering Flight teams trained in emergency response, as well as a Base fire department and a disaster control group. These groups, as needed, assist in emergency situations at the OD Unit. However, the EOD personnel would be the primary support for an emergency situated at the unit.

Implementation of the Contingency Plan

The Contingency Plan will be implemented immediately whenever there is a fire, spill, or uncontrolled explosion which could threaten human health or the environment. Such a fire would be defined as one that had spread outside the boundaries of the OD Unit to an extent that Holloman AFB personnel and equipment could not provide adequate containment.

Emergency Response Procedures

During an event not requiring implementation of the Contingency Plan, EOD personnel will alert Test Track personnel and the fire department via portable radio.

During an emergency situation which requires implementation of the Contingency Plan, the emergency coordinator would implement the following first level response procedures:

- Activate internal communications systems to alert emergency response personnel;

- Identify the character, exact source, amount, and areal extent of the released materials;

- Assess possible hazards to human health and the environment (both on-installation and off-installation);

- Take steps to mitigate the spread or reoccurrence of the fire;

- Notify appropriate state or local agencies, if needed;

- Assess possible hazards to human health or the environment as a result of the fire; and

- Remove/transport any untreated ordnance material if the fire occurs while ordnance material is still present at the site.

If, based on the assessment of possible hazards, the emergency coordinator determines that the fire could threaten human health or the environment on-installation, he would immediately notify the military police. If evacuation is considered necessary, the emergency coordinator would confer with military police on which areas should be evacuated. If, in the unlikely event that the emergency coordinator determines that the fire could threaten human health or the environment off-installation, he would immediately notify local authorities. If evacuation is considered necessary, the emergency coordinator would confer with local authorities and with military police on which areas should be evacuated. The emergency coordinator will also notify the National Response Center at 1-800-424-8802 and provide the Center with the following information:

- Name and telephone number of the reporter (emergency coordinator making the notification);

- Name and address of the facility (Holloman Air Force Base, Alamogordo, New Mexico);

- Time and type of incident (fire);

- Name and quantity of materials involved;

- The extent of injuries, if any; and
- The possible hazards to human health or the environment outside the facility.

If evacuation is required, the evacuation plan consists of military police providing direct notification to persons in the likely path of the fire to evacuate. However, no residential areas exist near the OD Unit, and the possibility of fire spreading to residential areas is extremely unlikely.

Emergency Response Equipment

Holloman AFB maintains a large inventory of equipment that can be used as emergency response equipment. Although this equipment is not dedicated solely for hazardous waste service, it can be used in response to a fire involving hazardous waste. A listing of the equipment that is available, numbers of items, and the locations of that equipment are included in the Contingency Response Plan, included in Exhibit G-1 of this permit application. After use, all durable emergency response equipment must be cleaned, inspected, and fit for its intended use prior to resuming operations at the OD Unit. All non-durable emergency response equipment which is disposed of must be replaced as soon as practicable.

Coordination Agreements

Holloman AFB maintains a full spectrum of emergency response services at the installation including a fully equipped fire response station, emergency medical services, military police, and a hospital (49th Medical Wing Hospital). These installation organizations have been contacted to familiarize responders with operations at the OD Unit. Arrangements have been made with these departments and they have been familiarized with the Contingency Plan. Although the capabilities of Holloman AFB exceed those of local emergency response services, arrangements have been made with the local volunteer fire departments in the cities of Alamogordo, Cloudcroft, and Alamo West to provide Holloman AFB with back-up firefighting skills, if needed.

Required Reports

Holloman AFB will note in their operating record the time, date, and details of any incident which requires implementation of the Contingency Plan. Within 15 days after an event which requires implementation of the Contingency Plan, an incident report will be prepared detailing the event and submitted to the Region VI Regional Administrator of the EPA and the New Mexico Environment Department. The report will include the following information:

- Name, address, and telephone number of Holloman Air Force Base;
- Date, time, and type of incident;
- Name and quantity of materials involved;
- The extent of injuries, if any;
- An assessment of actual or potential hazards to human health or the environment, where applicable; and
- Estimated quantity and disposition of recovered material that resulted from the incident.

Attachment F-1
OD Unit Standard Operating Procedures

Two Weeks Prior to Scheduled Detonation:

1.EOD chief selects EOD team. EOD chief conducts a briefing with the team, which includes the following topics: hazards involved, treatment procedures, pertinent technical orders to reference, safety precautions, and transport procedures.

2.EOD team conducts a range inspection in accordance with permit requirements. Specific problems inspected for include free-standing liquids, unexploded munitions, vegetation, burrowing, signs of runon/runoff, and debris. The EOD team also inspects the road leading to the OD unit to identify holes, ditches, or settling that could cause problems during the transportation of the munitions.

3.EOD team checks all items listed for treatment to identify proper disposal techniques, and calculates the total mass being detonated. The team ensures that the total mass does not exceed 20,000 pounds NEW per event, and also calculates net explosive weight.

4.EOD team notifies the flight munitions custodian of explosive requirements, to ensure that explosives will be on hand prior to scheduled operation.

5.EOD team ensures that all inspections of emergency response equipment, safety equipment, security devices, EOD vehicles, and operating equipment are up-to-date and that no problems exist.

One Week Prior to Scheduled Operation:

1.EOD team chief checks and verifies items to be treated, and checks calculations regarding amount of explosive to be used and net explosive weight.

2.EOD team chief checks with munitions to make sure explosives will be on hand for treatment event.

One Day Prior to Scheduled Operation:

1.EOD chief conducts briefing with team on the pending operation, and makes team assignments.

2.EOD team contacts munitions to draw explosive materials.

3.EOD team contacts munitions storage to ensure delivery time will be met.

4.EOD team draws and inspects all necessary equipment to ensure operability.

5.EOD team notifies base fire department, medical services, security police, base operations staff, and base environmental coordinator of pending operation.

6.EOD team contacts base meteorology team to get a forecast of predicted weather conditions for the following day, and to notify them of the operation.

Day of Scheduled Operation:

1.EOD team contacts base meteorology team to ensure that all weather conditions meet permit terms, including wind speed and direction, temperature, stability, and precipitation.

2.EOD chief conducts safety briefing with all team members, as well as highlights transportation of explosives requirements and procedures.

3.EOD chief provides arms to personnel who will be transporting explosives. Conducts a briefing on the use of firearms.

4.EOD chief ensures that radio communication lines are kept open with the EOD team during the drawing and transportation of explosive materials.

5.EOD team proceeds to munitions storage. EOD chief supervises the munitions loading operations.

6.EOD team transports munitions and explosives to OD unit.

7.EOD team conducts a final inspection of the OD unit.

8.EOD chief makes radio contact with the test track control and the EOD operations center. Ensures mobile two-way radios are placed in appropriate locations (with team members, track control net, team chief, and safety observer).

9.EOD team conducts a physical inspection of all munitions brought for treatment. Compares inventory listing with letter of disposal request to ensure all items are accounted for. (Only items identified on the letter of request can be treated; all others will be refused and returned to munitions storage for reschedule.) EOD chief will monitor and identify and deficiencies and refuse treatment if discovered.

10.Once inventory is completed, EOD team places items in the area for treatment.

11.EOD chief segregates initiation explosives and prepares firing set-up.

12.EOD team sets up dual-primed firing systems to initiate the main charge.

13.EOD chief checks firing systems in primed positions.

14. EOD team and EOD chief withdraw to safe area.

15. EOD chief obtains approval for detonation from the Holloman tower via test track control.

16. Waste is detonated.

17. Once detonation is evident, EOD chief makes long range reconnaissance of the surrounding area to determine presence of possible kick-outs and/or fires.

18. EOD chief dispatches two EOD team members to inspect the shot. Once the site is determined clear, remaining EOD team members can return to the detonation area. The OD unit is inspected to determine that the munitions were completely destroyed.

Post Operation Procedures:

1. Within 24 hours of the operation, the EOD chief will sign all required expenditure documentation, and place a copy in the project folder. A copy of the EOD report will be prepared, including an inventory listing and a list of personnel participating. The report will include the net explosive weight amount and the facility used.

2. EOD team cleans and inspects all EOD vehicles and other equipment.

3. If necessary, EOD chief makes arrangements to have depressions in the OD unit backfilled.

Attachment C-1
Sampling and Analysis Plan

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to support the Resource Conservation and Recovery Act (RCRA) Part B Permit Application for Holloman Air Force Base (AFB), New Mexico. This SAP provides procedures for the required routine environmental sampling at the 20,000-Pound Open Detonation (OD) Unit which is used to treat waste explosives. Environmental sampling is necessary to demonstrate that the OD Unit is operating in a manner that residual waste constituents are not contaminating soils above risk-based cleanup levels and/or background levels. The plan provides procedures to routinely test the soils at the OD Unit to monitor the effectiveness of the treatment process and to ascertain whether any contamination has impacted ambient soils.

The plan also explains how and where samples will be collected for chemical analysis. The plan's design is based on U.S. Air Force (USAF) OD operational procedures, knowledge of the waste munitions' characteristics, and the environmental conditions at Holloman AFB. Where applicable, the procedures and quality assurance/quality control (QA/QC) techniques in U.S. Environmental Protection Agency's (EPA's) November 1986 *Test Methods for Evaluating Solid Waste* have been used to prepare this SAP.

Specific topics covered in this plan include: the site descriptions, sampling approach and rationale, sampling procedures and methodology, health and safety procedures, sample handling and chain-of-custody (COC), sample documentation, laboratory procedures, QA/QC, and data evaluation methods.

2.0 SITE DESCRIPTION

The 20,000-Pound OD Unit is within the boundaries of Holloman AFB in Otero County, New Mexico, approximately 7 miles west of Alamogordo, New Mexico. The location of Holloman AFB and the exact location of the OD Unit are shown in Section B of the permit application, Figures B-1 through B-4. The 20,000-Pound OD Unit consists of a roughly circular area approximately 400 ft in diameter and is devoid of vegetation, rocks, and debris. The portion of the OD Unit that is used for detonations is confined to a 100-ft diameter area in the center of the larger cleared area. The OD Unit, as well as the environmental conditions, including geology, hydrogeology, topographic and drainage features, and climate at Holloman AFB, is described in detail in Section B and E of the permit application. Section D of the permit application describes the OD Unit's operation in detail.

3.0 SAMPLING APPROACH AND RATIONALE

3.1 Sampling Approach

Sufficient samples must be collected and analyzed to draw conclusions about the effectiveness of treatment and the levels of residual constituents in the surface soils at the OD Unit. The sampling strategy chosen for the OD Unit differs from a simple random sampling procedure, which is employed at other hazardous waste sites, because concentrations of contaminants are stratified horizontally. That is, the concentration of potential contaminants is greater and most variable at the detonation center and decreases with distance away from the detonation center.

At stratified sites, systematic radii sampling procedures are sometimes employed. The systematic radii method, however, has certain disadvantages in that incorrect conclusions may be drawn if the sampling pattern corresponds exactly or approximately to a pattern of contaminant distribution over space and time. Therefore, a stratified random sampling approach has been chosen for monitoring sampling at the OD Unit to help overcome this disadvantage. The stratified random sampling methodology and location selection procedures are discussed in more detail in Section 4 of this plan.

3.2 Chemical Analyses and Selection Rationale

This section summarizes the analytical procedures to be followed for proper site characterization. Soil samples will be analyzed for toxic metals, including priority pollutant metals (listed in the New Mexico Hazardous Waste Management Regulations-7, Part V, Appendix IX), explosive residues, and soil moisture. Table 3-1 lists all analytes that will be measured along with their EPA SW-846 test method. Analytical requirements are discussed further in Section 7.

The analytical test methods listed in Table C.1-1 were selected based on knowledge of the OD Unit's operational history. Holloman AFB has never been used for the research and development of nuclear, chemical warfare, or other exotic warfare types of weapons. The OD Unit is used solely for the disposal/treatment of conventional waste-ordnance, munitions, incendiaries, propellants, and rocket motors. The only

munitions delivered or disposed of at Holloman AFB have been conventional live and training munitions. Therefore, the chemical components and combustion by-products are consistent with what is typical for military munitions items; thus, the emphasis of sampling and analysis for the OD Unit should be to search only for the constituents present in these types of wastes.

This rationale is supported by the studies conducted to characterize emissions from thermal treatment of explosive munitions (the "Bang Box" studies conducted by Johnson et. al during 1991 and 1993). These studies included emissions analyses for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. Conclusions drawn from the emissions testing of selected ordnance found that VOCs were consistently detected at trace concentrations and that SVOCs were detected at approximately two orders of magnitude less than metals (which is the primary indicator and most persistent form of contamination). Together, this approach supports using the analytical methods described in Table C.1-1. Analysis for constituents not listed in Table C.1-1 should be considered only if the mission of Holloman AFB or the operation of the OD Unit changes.

Table C.1-1

Analytical Methods for Soil Samples

Parameter/ Constituent	EPA Hazardous Waste Number	Test Method	Reference
Explosive Compounds	D003	8330	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
HMX RDX 1,3,5-Trinitrobenzene (TNB) 1,3-Dinitrobenzene (DNB) Tetryl Nitrobenzene(NB) 2,4,6-TNT 2,4-DNT 2,6-DNT 2-Nitrotoluene (NT) 3-NT 4-NT			
Toxic Metals			Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).
Antimony Arsenic Barium Beryllium Cadmium Chromium Copper Lead Mercury Nickel Selenium Silver	-- D004 -- -- D006 D007 -- D008 D009 -- D010 D011	7041 7060 6010 6010 6010 6010 6010 7421 7471 6010 7740 6010	
Soil Moisture	--	3550	Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, EPA SW-846, 3rd Ed. November 1986 (amended).

4.0 SAMPLING PROCEDURES AND METHODOLOGY

4.1 Sampling Frequency

Soil sampling will occur annually to demonstrate that the OD treatment activities are being performed properly and that residual waste constituents are not contaminating soils above risk-based levels or background concentrations. Because the depressions left by detonations are periodically backfilled, the annual sampling must also occur prior to any site work (backfill, excavation, or construction).

4.2 Sample Location

Sample locations will be chosen based on a stratified random sampling approach to adequately characterize any residual contamination from the OD waste treatment residues. In general, a stratified random sample is obtained by separating a population into non-overlapping groups, called strata, and then selecting a simple random sample from each stratum. In this case, the "population" to be sampled is the potentially affected surface soils in the vicinity of the OD Unit. The term "strata," used in this context, refers to discrete horizontal zones of surface soil, not vertical geologic strata.

A stratified random sampling plan has been chosen for this site based on the unique contaminant distribution associated with detonation sites. There are two pertinent reasons why stratified random sampling often results in increased information for a given cost:

1. The data should be more homogenous within each stratum than in the population as a whole; and

2. When stratified sampling is used, separate estimates of population parameters can be obtained for each stratum without additional sampling.

Sampling locations will include the area where the unexploded ordnance is placed for destruction and all areas outside that area or the OD Unit that may have received ejecta, metal fragments, or explosive residues resulting from treatment activities. The OD area will be divided into three strata for sampling purposes: (1) Stratum A, (2)

Stratum B, and (3) Stratum C (see Figure C.1-1). As described further in the next section, sampling will be weighted toward the prevailing wind direction. Prevailing wind direction will be determined prior to each detonation episode and will be noted in the field logbook to ensure that proper sampling locations are chosen following detonation.

4.2.1 Description of Sampling Strata

The areas that will be sampled are shown in Figure C.1-1 and are described below:

Stratum A: 0 to 15 ft—Stratum A includes the center of the *most recent* detonation pit and the area up to a 15-ft radius from the center. It is assumed that this area possesses a normal contaminant distribution and is representative of soil directly affected by detonation events.

Stratum B: 15 ft to Edge of Detonation Area—Stratum B is the intermediate zone between Stratum A and the edge of the active detonation area. (Because a given detonation may be situated anywhere within the 100-ft diameter detonation area, the maximum distance from the most recent detonation pit could be 100 ft.) It is assumed that this area possesses a normal contaminant distribution. It will contain fallout close to the detonation and may contain areas previously used for detonation that have since been backfilled. Due to prevailing wind direction, higher concentrations of contaminants could exist in a downwind direction. To compensate for this possibility, the prevailing wind direction will be noted for each detonation period. It is assumed that the area 45º on either side of the prevailing wind direction will be the most contaminated. Therefore, samples will be randomly chosen in this area to produce a more conservative estimate of residual concentration in the soil. See Figure C.1-1 for an example of Stratum B.

Figure C.1-1. Soil Sampling Strata and Potential Sampling Locations

Stratum C: Edge of the Detonation Area to OD Unit Boundary—Stratum C is designated as the outer zone situated from the edge of the detonation area to the OD Unit boundary. It is assumed that this area also possesses a normal contaminant distribution, consisting of fallout from the detonation event. Because no detonations take place in this stratum, however, it is distinct from Stratum B. Due to prevailing wind direction, higher concentrations of contaminants could exist downwind, as was indicated for Stratum B. To compensate for this possibility, it also will be assumed that the area 45º on either side of the prevailing wind direction will be the most contaminated. Therefore, samples will be randomly chosen in this area to produce a more conservative estimate constituent concentration.

If fallout from a detonation event visibly exceeds the edge of the OD Unit—the edge of Stratum C—then two additional samples will be collected outside the perimeter of Stratum C at visually observed impact areas; upon analysis of results a Stratum D will be determined.

4.3 Quality Control Samples

This section addresses requirements for field QC samples. Quality control in the field begins with adherence to the specified sampling protocols (see Section 4.4), but is monitored by a variety of samples taken with sufficient frequency to test the accuracy and precision of field samples. To measure QC in the field, duplicates and matrix spike/matrix spike duplicate (MS/MSD) pairs will be collected. Refer to Table C.1-2 for an explanation of the field QC requirements and procedures.

Table C.1-2

QC Sample Requirements

Sample Type	Frequency	Purpose	Method
Field Duplicate	10%; or minimum of 1 per sampling event[1]	To ensure sampling procedures are reproducible and that the sample is representative of the location.	Collect twice the normally required sample volume. Split the sample into two aliquots. Treat each portion as if it were a separate sample and submit for analysis.[2]
MS/MSD	1 pair per 20 samples; or minimum 1 per sampling event	Assess the efficiency of extraction, accuracy of the anlaysis, and possible matrix effects. The MSD assesses the precision at known concentrations.	Collect twice the normally required sample volume and specify MS/MSD analysis at laboratory.

[1]Location will be selected from one of the three strata. A different location and strata will be selected for each sampling event.

[2] Analytical methods, sample container requirements, and holding times are listed in Table 5-1.

4.4 Sampling Methodology

4.4.1 Required Sampling Equipment and Procedures

Required sampling equipment includes a hand-powered soil auger for excavation, containers consisting of 100- to 500-mL glass bottles, plastic caps, a small stainless steel or Teflon-lined trowel, small stainless steel or Teflon-lined spatulas/scoops/spoons, and adhesive labels for sample identification. Sampling procedures will be performed in accordance with American Society for Testing and Materials (ASTM) D 1452, “Standard Practice for Soil Investigation and Sampling by Auger Borings,” where applicable.

In general, sampling will be collected by initially advancing the hand auger the length of the bucket (approximately 3 to 6 in.) into the soil. The sample will then be removed from the auger and placed in a stainless steel bowl. The auger will then be inserted back into the hole and advanced. This procedure will be repeated until the desired depth (no more than 12 in.) has been reached. At this point, the collected soil

should be homogenized in the bowl using the spatulas or spoons described above. Appropriate quantities of the soil will be transferred to the sample containers for analysis. (Refer to Section 5 for sample handling and chain-of-custody procedures.)

Appropriate sampling information (date, time, sample number, etc.) and observations about the sample location will be recorded in the field logbook. Sampling equipment will be cleaned according to the decontamination procedures described in Section 4.5 of the SAP. Clean sampling equipment will be used at each sampling location. Field logbooks and COC forms will be completed in accordance with Section 5 and 6 of this SAP.

4.4.2 Background Sampling

Prior to the first annual sampling event, six surface soil samples will be collected around the OD Unit to establish background concentrations of metal constituents to be used in future comparisons. Background samples are intended to be representative of metal constituent levels in unaffected soils of similar type in the vicinity of the OD Unit. Surface soil samples will be collected as described in Section 4.4.1 above. The six background locations will be located at a distance between 200 and 1000 ft from the edge of the OD Unit in soil of similar lithology as within the OD Unit. Samples should not be collected at any location where surface soils appear to be disturbed or near to other contaminant source areas. The location of each sample will be marked on the site map.

The background samples will be analyzed for the metal constituents listed in Table C.1-1 of this SAP. Section 9, Data Evaluation Methods, discusses the treatment of the data to establish background levels.

4.4.3 Annual Sampling

Annual sampling will be conducted at the OD Unit following the three-strata model. At a minimum, three random sample locations will be selected from within each strata. Prior to each annual sampling event, the detonation center from the last detonation event will be located. The detonation center will be used to determine the exact position of the three strata for that sampling event. Using the strata definitions in Section 4.2.1, the three strata will be delineated, the appropriate number of sample locations will be selected and located randomly, and sampling will be conducted in accordance with this SAP.

Three samples from each strata were chosen to produce somewhat statistically meaningful results. This value is not based upon any statistical formula, but can be used as a preliminary estimate to determine the population mean and variance. Using standard statistical methods for stratified random samples (described in *Sampling Techniques*, Cochran, 1972) the sample size can be further evaluated and modified for subsequent sampling events.

At the completion of each annual sampling round, all sampling locations will be recorded on a drafted site map and taped into a bound sampling log. (Complete documentation procedures are described in Section 6.)

4.4.4 Closure Sampling

In the event that the OD Unit is closed, a final round of sampling will be completed. Because abundant data will have been gathered during prior annual sampling events and it is important to verify that the entire area of the OD Unit has been adequately sampled, a non-stratified approach will be used. For example, a geostatistical approach may be used for determining the placement and numbers of samples for closure. This approach will account for the spacing of prior samples and identify areas where additional sampling will be required.

Using known locations of prior sampling results, geostatistical analysis uses a concept called *semivariogram analysis* to define the *range* for a given set of data. The range of the data is then used to define the desired sample grid spacing and estimate concentrations at unsampled locations. Using this approach, the closure round of sampling can be structured to included sufficient, but not too many, sampling points. Refer to Statistics for Spatial Data (Cressie, 1993) for methodology on performing geostatistical analysis.

4.5 Contamination Control Procedures

Sampling tools and equipment will be protected from contamination sources before sampling and decontaminated before and between sampling points. Sample containers will also be protected from contamination sources. Sampling personnel will wear clean chemical-resistant gloves when handling the sampling equipment and samples. Gloves will be decontaminated or disposed of between samples.

To prevent cross contamination, sampling equipment will be subject to decontamination procedures following each sample collected at each location. Sampling equipment will be decontaminated in a decontamination zone by being:

- Brush-scrubbed in tap water and Liquinox detergent wash in a tub to remove any soil from the equipment;
- Rinsed in tap water in a separate tub;
- Rinsed with deionized water;
- Rinsed with isopropanol;
- Air-dried in an area upwind of the decontamination process; and
- Stored for future sampling after being wrapped in aluminum foil (shiny side out).

4.6 Health and Safety Procedures

If deemed necessary, personnel performing sampling activities will use personal protective equipment such as rubber gloves, boots, aprons, Tyvek coveralls, and eye protection. Personnel will not be permitted to conduct any sampling until they have been cleared by EOD personnel and the high-speed test track security police. Sampling personnel will be properly trained in hazardous waste sampling, and have a minimum of one year of sampling experience. Personnel will also have 40-hour 29 Code of Federal Regulations (CFR) 1910.120 Occupational Safety and Health Administration (OSHA) training and appropriate medical monitoring and certification. Sampling personnel will also be briefed by Holloman AFB EOD personnel on the hazards of sampling explosive compounds.

5.0 SAMPLE HANDLING AND COC

COC procedures will be followed to track possession of the samples from the time they are collected until the analytical data from the samples are received and recorded. For all soil samples, procedures will begin once sampling is complete. A sample will be considered under custody if it is:

- In the possession of the sampling team;
- In view of the sampling team; or
- Transferred to a secure area.

An area is considered secure only when it is locked and access is controlled. The sampling team leader is responsible for custody of the collected samples in the field until they have been properly transferred to the shipping coordinator, who is responsible for sample custody until the samples are properly packaged, documented, and released to a courier or directly to the analytical laboratory. A triplicate COC record form will be used for the sampling effort.

5.1 Sample Container and Preservation Requirements

Samples will be collected in pre-cleaned sampling containers and will be kept cold during transportation and shipping. Table C.1-3 summarizes the containers, preservative, and holding time requirements for the samples to be collected. Laboratory-specific container requirements should be verified with the contracted analytical laboratory prior to sample collection.

Table C.1-3

Summary of Sample Container, Preservative, and Holding Time Requirements for Soil Samples

SW 846				

Method	Analyte	Container	Preservative	Holding Time

6010	Metals (Sb, Ba, Be, Cd, Cr, Cu, Ni, Ag)	500-mL wide-mouthed glass or plastic jar	None, cool, 4ºC	6 months for digestion and analysis except for mercury which must be digested and analyzed in 28 days.

7471	Mercury			

7421	Lead			

7041	Antimony			

7740	Selenium			

7060	Arsenic			

8330	Explosive residues	500-mL wide-mouthed glass jar with Teflon-lined cap	None, cool 4ºC	14 days to extraction 40 days after extraction

5.2 Packaging and Transportation

At the end of each sampling day, samples will be packaged in shipping containers with double-bagged ice packs to maintain a temperature of less than 4°C. The samples will be carefully packaged so that they will not break during shipping and should contain absorbent material capable of containing all liquid. Each shipping container will be sealed with custody seals and shipped to the analytical laboratory by an overnight delivery service.

6.0 DOCUMENTATION OF ACTIVITIES

6.1 Sample Identification

Sample containers will be uniquely identified to indicate the site, the individual composite sample's location, the treatment unit, and date. Examples of a sample code for the three sampling zones are listed below:

- 20K-A01-110595 (OD Unit sample number 01 taken within Stratum A on November 5, 1995);
- 20K-B01-110595 (sample number 01 from Stratum B of the OD Unit taken on November 5, 1995); and
- 20K-C01-110595 (sample number 01 from Stratum C of the OD Unit taken on November 5, 1995).

6.2 Sample Labels

The samples collected will be identified by an adhesive label containing the following information:

- Collector's initials;
- Sample ID;
- Analytical methods requested;
- Place of collection (facility and location);
- Date sample taken; and
- Time sample taken.

Any other information required by the laboratory or deemed necessary by project personnel will also be added to the label.

6.3 Field Sampling and Unit Operation Logbooks

All the methodology, procedures, and events pertaining to sample and data acquisition will be recorded in bound, water-resistant field logbooks with a black waterproof ink pen. The logbooks will be considered formal documents representing a complete and organized record of all field activities. The entries will include, but not be limited to the following:

- Personnel present; name of sampler(s);
- Date and time of every recording;
- Work location;
- Description of work and treatment process;
- Purpose of sampling;
- Soil sample descriptions;
- Description and location of area sampled;
- Sample numbers;
- Field QC data;
- Other important notes on field activities, conditions, or problems; and
- Initials/signature of person entering data.

Entries made in the logbook should be of sufficient detail to reconstruct the taking of a sample by the reading of the entries and information recorded in it. No erasures or deletion marks are permitted. If a mistake is made in a logbook, it must be corrected by marking a line through the error and initialing. The correction may be made in space available on the page.

A similar log book will be maintained by EOD personnel that documents each detonation event. At a minimum, it should include the date, material detonated, prevailing wind direction, size of depression formed, and distance debris was scattered.

This log book will be used in conjunction with the field sampling logbook to situate samples during annual sampling events.

7.0 LABORATORY ANALYSIS

7.1 Laboratory Specifications

Design and execution of the testing program will be coordinated with an analytical chemist experienced in contaminated soil testing. The laboratory procedures and QA/QC specifications will follow those set forth in the Quality Assurance Project Plans (QAPP) for the 300-Pound Open Burn Area as presented in the 300-Pound Open Burn Area Closure Plan (Radian, 1995). The following is a summary of these laboratory specifications and procedures.

At a minimum, the laboratory report will state the following:

- Unique laboratory ID;
- Field sample ID;
- Sampling date;
- Preparation date;
- Analysis date;
- Preparation batch;
- Preparation method;
- Analysis batch;
- Analysis method;
- Analyte;
- Results;
- Footnotes;
- Units;
- Sample matrix;
- Sample-specific detection limit;
- Dilution factor;
- Matrix spike recoveries;
- Surrogate spike recoveries (for all samples, blanks, and laboratory QC samples);
- Case narrative (if necessary);
- Dry weight;
- Blank sample results; and
- Laboratory control sample results.

SW-846 addresses all procedures proposed in this SAP. The laboratory will be required to achieve the required or estimated detection limits as specified in SW-846. If

equivalent methods are used, this must be justified in advance. Approval for any equivalent methods employed by the laboratory will be at the discretion of Holloman AFB and New Mexico Environment Department (NMED).

Soil samples will also be analyzed for soil moisture content, in accordance with SW-846.

7.2 QA/QC Protocols

For all inorganic tests, the samples will be spiked with known quantities of the hazardous constituent and spike concentration and percent recovery (PR) reported. For organic tests, the samples may be spiked with a subset of target analytes. The surrogate spike recoveries will be reported for all organic tests. Results from method blanks on the samples will be submitted. Blank results will not be subtracted. The method of how the reported lower detectable limit was determined must also be reported. To ensure that the established data quality objectives (DQOs) can be attained, the level of analytical quality achieved will be at least Level III. Data will be sufficiently documented to allow personnel to review and evaluate data quality and have all reporting requirements to achieve Level III data quality. Level III data will allow Holloman AFB to determine whether, based on the results, the OD treatment process is affecting the environment.

7.3 Sampling DQOs

DQOs are quantitative and qualitative statements specified to ensure that data of known and appropriate quality are obtained during sampling. The overall objective of sampling is to provide an accurate, precise, and representative confirmation that the OD Unit treatment process is not contaminating surrounding soils above risk-based levels or background levels. DQOs will be followed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC). The PARCC parameters indicate measurement data quality. The procedures described in this section are designed to obtain PARCC for each sampling and analytical method and analysis.

7.3.1 Precision

Precision is a measure of variability between duplicate or replicate analyses, and is calculated for field and laboratory replicates. By definition, field or total, precision incorporates laboratory precision. Precision is calculated as the relative percent difference (RPD) between duplicate samples or analyses, or matrix spike/matrix spike duplicates as appropriate. The calculated RPDs are compared to the objectives stated in the method. Results that do not satisfy the objectives are assigned a data qualifier flag indicating uncertainty associated with imprecision.

An average RPD may be calculated and reported as a measure of overall analytical precision for compounds with multiple measurements. The specific samples collected or analyzed in duplicate are flagged if they do not satisfy the QA objectives. In addition, associated samples may be flagged to indicate variability due to poor precision. For poor field duplicate precision, samples collected by the same sampling team, from the same equipment, or on the same day may be affected; close evaluation of those results should indicate the most likely source of variability, and the corresponding samples will be qualified as warranted. For poor laboratory precision, samples processed and analyzed in the same batch will be more closely evaluated, and any anomalous result will be qualified.

The QA coordinator is responsible for ensuring that data qualifier flags are assigned to the data as required by the established QC criteria, and that they are reported and understood by project staff using the data for specific applications. The QA coordinator is also responsible for initiating corrective actions for analytical problems identified during the QC data assessment process. These corrective actions range from verifying that the method was in statistical control during the analytical runs, to re-analysis of the sample, or resampling.

7.3.2 Accuracy

Accuracy is associated with correctness, and is a comparison between a measured value and a known, or 'true' value. Accuracy is calculated from method spike (spikes of the pure matrix) matrix spike, or Laboratory Check Sample results.

Spike results are reported by the laboratory as percent recovery and are compared to the accuracy objectives stated in the method. Results that do not satisfy the objectives are assigned a data qualifier flag to indicate uncertainty associated with inaccuracy.

Method spikes are spikes of a reference material into a water matrix. If recovery is outside the established limits, samples from the same extraction batch may be qualified. Matrix spike results are generally more sample-specific. If matrix spike recovery is outside the established limits, results for samples collected from similar conditions and/or handled in the same batch will be examined. If any results appear atypical and could be related, those results may also be qualified. The flagged data will be discussed in the QA/QC report for the sampling task, and specific limitations such as poor or enhanced recovery for specific compounds will be stated. Further investigation or corrective action may be taken to find methods to reduce the interferences.

Surrogate spike results are also reported and used to assess recovery of target analytes on a sample by sample basis and provide a measure of system performance. Surrogate spike recoveries are compared to recovery limits. Any results outside the limits are flagged on laboratory reports and in the database. Any corrective action taken in the laboratory is documented in laboratory performance records and/or discussed in the comment section of the data report.

Confidence intervals can be calculated for an analytical method if performance evaluation samples are submitted or a series of method spikes is analyzed. The results are used to define confidence intervals for the recovery of each compound analyzed.

7.3.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criterion is satisfied by carefully selecting sample locations, sampling techniques, and analytical techniques and collecting a sufficient number of samples. Adherence to this SAP will ensure that sufficient representativeness has been achieved.

7.3.4 Completeness

Completeness is calculated after the QC data have been evaluated, and the results applied to the measurement data. In addition to results identified as being outside of the QC limits established for the method, broken or spilled samples, or samples that could not be analyzed for any other reason are included in the assessment of completeness. Analytical results for methods or analytes outside the established QC limits are considered questionable and are unusable for the RI and risk assessment. These results will be considered invalid and will be flagged with an "R". The percentage of valid results is reported as completeness.

Completeness will be calculated as follows:

Install Equation Editor and double-click here to view equation.

where: T = Total number of expected measurements for a method and matrix;
I = Number of invalidated results for a method and matrix; and
NC = Number of results not collected (e.g., bottles broken etc.) for a method and a matrix.

7.3.5 Comparability

Comparability reflects the confidence with which data sets can be compared to each other. This is accomplished through use of standard sampling techniques for all sampling events and standard analyzing techniques for all samples. Comparability is limited to the precision and accuracy parameters of PARCC, because only when these parameters are known can data sets be compared with confidence.

7.4 Blank Data Assessment

Reagent blank results indicate whether any of the contaminants reported in sample results may be attributed to laboratory sources (reagents, glassware, instrumentation) and were not likely present in the sampled medium. The most common laboratory contaminants are methylene chloride, phthalate, acetone, and toluene; these are recognized as being ubiquitous in the laboratory environment and controlling them to within acceptable low levels is part of standard laboratory procedures.

If contamination from these compounds is reported in reagent blanks, the samples associated with the blank, either the same analytical or extraction batch, may be qualified to indicate that some or all of these compounds may be from laboratory sources. If the concentrations reported in the samples are similar to the blank concentrations, it is likely that all of the contamination was introduced, and this assessment is made in the QA/QC report for the sampling task.

In some cases, where there is a large sampling task and reagent blank results indicate a more significant contamination problem, a more systematic approach may be applied. This approach is only used when a series of reagent blanks analyzed over a period of time are reported. The assessment criterion is calculated from reagent blank results as the mean concentration plus three standard deviations for each contaminant reported. The sample data are assessed using this criterion. Sample concentrations below the criterion are considered to be most likely from laboratory sources, and at least some of the sample concentrations higher than that are considered to be from the sampled medium. This semi-quantitative approach is used only as a tool to screen the sample results and provide a common basis for further assessment; none of the results are censored or changed in any way. The assessment is discussed in a QA summary report

for the sampling task. Samples with blank contamination problems will be assigned a data qualifier flag.

7.5 Sample Return or Disposal

Unless directed otherwise by Holloman AFB, the laboratory will dispose of all soil samples following analysis. The laboratory will provide certification that its facilities qualify for the exemption in 40 CFR 261.4(d), which excludes waste samples from many hazardous waste management requirements. In addition, all laboratories will provide the base with an explanation of the disposal practices used with respect to sample residual.

8.0 DATA EVALUATION METHODS

8.1 Establishment of Background Concentrations

Action levels for metal constituents at the OD Unit will be calculated using the data obtained from the six preliminary background samples. Specifically, the action levels will be set by using the upper tolerance limit (UTL) of background data for each analyte. The UTL is calculated to represent an estimate of the upper 95th percentile with 95% confidence of the true background concentration of the analyte of interest. Using this statistical approach, there is a relatively small chance, on the order of 1 in 20, of a background soil sample having a metal concentration greater than the UTL. When individual samples are compared to the UTL, they are interpreted to indicate the presence of contamination above background levels when they exceed the UTLs. Conversely, samples are considered to be not different from background (i.e, below action levels) as long as they do not exceed the UTL. The UTL will be calculated using EPA statistical methods (EPA, 1992).

Because historical background data exists at Holloman AFB (see the *Base-Wide Background Study*, Radian, 1993), comparable results will be evaluated and may be used in addition to the six new background samples in calculating the action level for metals at the 20,000-Pound OD Unit.

8.2 Annual Sampling Results Comparison

All valid analytical data from annual sampling activities will be compared against risk-based levels or background UTLs to determine if a significant release of the targeted explosive and metal compounds has occurred (see Table C.1-1 for specific analytes). The action levels that will be used for annual monitoring are a combination of calculated risk-based values and background UTLs. Risk-based values will be calculated in accordance with the most current guidance and toxicity data. Metals will first be compared to background UTLs and if an exeedence occurs, the concentration will then be compared against the risk-based concentration for that analyte.

8.3 Data Resolution and Remedial Response

In the event that soil sampling results determine that action levels of a hazardous constituent are exceeded at any sampling point, the sampling point will be immediately resampled to confirm the presence of contamination. In any event where contamination is confirmed, such an occurrence will be noted, NMED will be duly notified in writing, and a report describing the occurrence will be submitted to NMED within seven days of the sample confirmation.

To prevent future contamination the OD Unit Operations will be reevaluated and modified if appropriate.

Each of these potential solutions will require coordination with NMED and will be completed in a timely manner to help minimize the potential spread of contamination and risk to human health and the environment.

9.0 REFERENCES

Draft Closure Plan, 300-lb Open Burn Area. Radian Corporation. April, 1995.

Elementary Survey Sampling. William Mendenhall et al., 1971. Pgs. 53-64.

Sampling Techniques. William G. Cochran, 1977. Pgs 89-149.

Spatial Data. Nole A.C. Cressie. John Wiley and Sons, Inc., 1993.

U.S. Environmental Protection Agency (EPA), June 1992. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Addendum to Interim Guidance*, Office of Solid Waste, Washington, D.C.

EPA, November 1986. *Test Methods for Evaluating Solid Waste*, SW-846, 3rd Edition, Office of Solid Waste and Emergency Response, Washington, D.C.

List of Acronyms

AAQS Ambient Air Quality Standards
ACC Air Combat Command
AFB Air Force Base
AFMC Air Force Materiel Command
AFSC Air Force Systems Command
AQCR Air Quality Control Regulations
ASTM American Society for Testing and Materials
BGS Below Ground Surface
CES Civil Engineering Squadron
CFR Code of Federal Regulations
COC Chain of Custody
COMSEC Communications Security
DDNP Dizodinitrophenol
DQOs Data Quality Objectives
EOD Explosive Ordnance Demolition
FML Flexible Membrane Liner
HMX Cyclotetramethylenetetranintramine
HQ Headquarters
MSL Mean Sea Level
MS/MSD Matrix Spike/Matrix Spike Duplicate
NEW Net Explosive Weight
NMED New Mexico Environment Department
NMHHS New Mexico Human Health Standards
NMHWMR New Mexico Hazardous Waste Management Regulations
NMWQCCR New Mexico Water Quality Control Commission Regulations
OD Open Detonation
OEL Occupational Exposure Limit
OPSEC Operations Security

List of Acronyms (Continued)

OSC On-site Coordinator

OSHA Occupational Safety and Health Administration

PARCC Precision, Accuracy, Representativeness, Completeness, and Comparability

PETN Pentaerythrite Tetranitrate

PPE Personal Protective Equipment

QA/QC Quality Assurance/Quality Control

QAPP Quality Assurance Project Plans

RCRA Resource Conservation and Recovery Act

RDX Cyclotrimethylenenitramine

RPD Relative Percent Difference

SAP Sampling and Analysis Plan

SVOCs Semivolatile Organic Compounds

TAPs Toxic Air Pollutants

TDS Total Dissolved Solids

TNT Trinitrotoluene

TO Technical Order

TSD Treatment, Storage and Disposal

USAF United States Air Force

USEPA U.S. Environmental Protection Agency

UTL Upper Tolerance Limit

VOCs Volatile Organic Compounds

RCRA PART B PERMIT APPLICATION

HOLLOMAN AFB 20,000-POUND

EXPLOSIVE DISPOSAL AREA

November 3, 1988

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Prepared for
49 CES/CEV
Holloman AFB, New Mexico 88330-8458

Prepared by
LEE Wan & Associates. Inc.
700 S. Illinois Avenue
Suite A-202
Oak Ridge, Tennessee 37830
under subcontract to
Entech, Inc.
540 Powder Springs Street, S.W.
Marietta, Georgia 30064-3559

Revised by
49 CES/CEV
Holloman AFB, NM 88330-8458
April 1991
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LIST OF ACRONYMS

AFB	Air Force Base
AFCC	Air Force Communications Command
AFLC	Air Force Logistics Command
AFSC	Air Force Satellite Command
ALMC	Army Logistics Management Command
ASTM	American Society for Testing and Materials
BLS	below land surface
CFR	Code of Federal Regulations
COR	Contracting Officer Representative
DDNP	diazodinitrophenol
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
DRMR	Defense Reutilization and Marketing Region
DRMS	Defense Reutilization and Marketing Service
EAV	Environmental Quality Assurance Visits
ED	explosive disposal (30,000 Explosive Ordnance disposal Facility)
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
EP	Extraction Procedure, Method 1310 (per 40 CFR 261, Apps. II and III)
FML	flexible membrane liner
GC	gas chromatography
HMDI	hexamethylene diisocyanate
HMIS	Hazardous Material Information System
HMX	cyclotetramethylenete tetranitramine
Kcal/mol	thousand calories per mole
MEK	methyl ethyl ketone
MIBK	methyl isobutyl ketone
MILSPEC	military specification
MOBSS	Mobility Support Squadron
MS	mass spectroscopy
MSDS	Material Safety Data Sheet
MSL	mean sea level
MT	Moving Trench (300 Pound Moving Trench Facility)
NAAQS	National Ambient Air Quality Standards
NC/NG	nitrocellulose/nitroglycerin
NDI	Nondestructive Inspection
NEMA	National Electrical Manufacturers Association
NMEID	New Mexico Environmental Improvement Division
NMHWR	New Mexico Hazardous Waste Rules
NRC	nonreusable container
NSN	National Stock Number
OSC	ON-Scene Coordinator
OEHL	Occupational and Environmental Health Laboratory
PCB	Polychlorinated biphenyl
PEL	permissible exposure limit
PETN	pentaerythrite tetranitrate
PELT	Paint Filters Liquid Test
PMEL	Precision Measurements Engineering Laboratory

LIST OF ACRONYMS (Continued)

PPE	personnel protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QPL	qualified product listing
RCRA	Resource Conservation and Recovery Act
RDX	trimethylene trinitramine
SCS	Satellite Communications Squadron
SP gr	specific gravity
SPR	Spill Prevention Response
SRT	Spill Response Team
STC	single trip container
TAC	Tactical Air Command
TCA	trichloroethane
TCE	trichloroethylene
TDI	toluene diisocyanate
TDB	total dissolved solids
tartly	trinitropheylmethylnitramine
TKN	total kjeldahl nitrogen
TO	Technical Order
TOC	total organic compounds
TOX	total organic halides
TSCA	Toxics Substance Control Act
TSDF	Treatment, Storage, and Disposal Facility
TNT	trinitrotoluene
USAF	United States Air Force
VOC	volatile organic compound

SECTION A

HAZARDOUS WASTE PERMIT APPLICATION

SECTION B

FACILITY DESCRIPTION

B-1 GENERAL DESCRIPTION

Holloman Air Force Base (AFB) is located on approximately 50,700 acres of land in Otero County of South-central New Mexico. The Facility lands are situated in the northern Chihuahuan Desert in the region known as the Tularosa Basin that is bounded to the east and west by the Sacramento and San Andres Mountains, respectively. The base is located adjacent to White Sands Missile Range and White Sands National Monument is located south of the base. Regional water supplies are derived from Bonita Lake located approximately 60 miles north of the base and the Boles, Douglas, and /San Andres Well Fields located 14 miles to the southeast.

The nearest population center is the city of Alamogordo located approximately 7 miles to the east. Regional metropolitan centers include El Paso, Texas, located 75 miles south-southwest and Albuquerque, New Mexico, located 210 miles north of the facility. The primary transportation route for the facility is Highway 70 that traverses the southern boundary of the base in a northeasterly direction. The general location of Holloman AFB is depicted in figure B-1, volume 2.

Holloman AFB was initiated as a temporary facility developed to provide gunnery and bomber training to aircrews during World War II. The base mission was altered in the postwar years to the development of pilotless aircraft, guided missiles, and associated equipment. In the late 1950s the base was transferred to the Air Force Systems Command (AFSC) and designated as the Air Force Missile Development Center. On January 1, 1971 , the base mission expanded to provide lead-in fighter training for the 479th Tactical Training Wing and its components..

Currently, Holloman AFB hosts the Air Combat Command (ACC) 49th Fighter Wing, which includes pilot training, mobility support, and combat support operations. The primary AFSC component located at Holloman AFB is the 6586th Test Group, which is responsible for evaluation of propulsion and navigational systems for aircraft, space vehicles and missiles. A variety of tenant organizations are assigned to Holloman AFB including the 4th Satellite Warning Squadron, the New Mexico State University Primate Research Laboratory, the 4th and 25th Weather Wing. A general layout of the facility is provided in Figure B-2, Vol 2.

As a result of ACC readiness requirements and the 46th Test Group activities, a variety of ordnance, munitions, incendiaries, and propellants

become waste because of exceedance of shelf-life, unanticipated deterioration, or failure to attain specifications that render the device non-serviceable. These waste explosives are considered characteristically hazardous under the Resource Conservation and Recovery Act (RCRA) due to reactivity (D003). Rocket motors that exceed 300lbs are treated at the 20,000-Pound Explosive Disposal (20,000lb ED) Area that is the subject of this permit. These units are regulated under 40 CFR 264, Sub-part X, codifies at 40 CFR 264.600 et seq.

The 20,000lb ED Area consists of a clear zone of a clear zone of approximately 1680 feet in diameter. A graded circular area of approximately 200 feet encircles the treatment pits and has an earthen berm that ranges from approximately 1 to 2 feet in height. A firebreak of approximately 6 feet in width encircles the entire area and also serves as a security road for the unit.

The 20,000lb ED Area derives its name from the relevant operating procedures for this treatment activity. The total mass of solid propellant rocket motors that are simultaneously treated in the trench is limited to 20,000 pounds. This total includes the mass of the casings, other associated containment devices, and detonating charges. Although the precise number of treatment occurrences during any year is variable, discrete treatment events occur at typical frequencies of one event every 2-3 months. More specific information on ordnance constituents, trench construction, and operating procedures is provided in future sections.

The treatment zone is developed by excavation of two circular pits, approximately 20 feet apart, with approximate dimensions of 40 to 60 feet diameter and 10 feet in depth. Treatment of the wastes is accomplished by placement of the propellant item and C-4 charges into the deepest pit with the waste subsequently detonated. After completion of the detonation, the area is thoroughly inspected to ensure that the waste has been destroyed and to collect ejected residuals. Once inspection is completed, the pit is closed by backfilling with the original soil. The location of this unit and its surrounding area relative to the main base is provided in Figure B-3, Vol 2.

B-2 TOPOGRAPHIC MAP

The general requirements are met in a topographic map of the 20,000lb ED Area and the surrounding area in Figure B-4, Vol 2. The provided topographic map indicates that the unit is located in relatively flat terrain for above the 100 year floodplain boundaries. No surface water of constant flow conditions is located in the area, although arroyos that contain runoff are located in the vicinity of the unit.

The topographic map delineates the area relief at intervals of 25 feet. the map scale of 1 inch equal to 400 feet is used in all Holloman AFB facility maps. Because of the cleared nature of the area and limited topographic relief, this

topographic map delineates the area in the same detail as that provided by a scale of 1 inch equal to 200 feet.

B-2a SURROUNDING LAND USES

THE 20,000lb ED Area is located approximately 2600 feet within the northern boundary of Holloman AFB. White Sands Missile Range lies to the north and west of the adjacent base boundaries. All lands within Holloman AFB boundaries are under the control of the U.S. Air Force. Thus, the unit is surrounded by federal lands for a distance of several miles in all directions.

B-2b UNIT BOUNDARIES

The unit boundary is designated in Figure B-4. This figure also delineates the clear zone surrounding the unit which extends to a radial distance of 8150 feet. Holloman AFB facility boundaries are designated in Figure B-3, Vol 2.

B-2c WIND ROSE

Wind roses are provided separately in Exhibit E-6. Pertinent meteorological data, including wind dispersion modeling, are also provided in Section E-3.

B-2d ACCESS CONTROL

Access to the unit is provided by a single paved road that terminates at the entrance to the unit. Access is controlled by Test Track safety personnel with radio contact with the Track Control Facility.

B-2e INJECTION AND WITHDRAWAL WELLS

No injection or withdrawal wells are located within the unit's boundary or the adjacent area. There are no wells located within the clear zone surrounding these munitions areas. The location of groundwater wells within the boundaries of Holloman AFB and the location of wells in the areas adjacent to the base boundaries are discussed in Section E-1. Hydrogeologic data for Holloman AFB are also presented in Section E-1.

B-2f STRUCTURES

No buildings are located within the 20,000lb ED Area. All nonordnance-related structures located within the clear zone are vacated prior to operations and cordoned off during the operations.

B-2g RECREATION ACCESS

No recreation areas are located in the vicinity of the 20,000 ED Area.

B-2h RUNOFF CONTROL SYSTEMS

Runon and runoff control systems are not present in the vicinity of the 20,000lb ED Area. Such systems are unnecessary in the area of the unit due to limited precipitation received and the limited slope of the surrounding area.

B-2i ACCESS AND INTERNAL ROADS

The only access to the 20,000lb ED Area is a paved surface that terminates at the entrance to the unit.

B-2j STORM, SANITARY, AND PROCESS SEWERS

No storm sewers, sanitary, or process-related conveyances are located within the vicinity of the 20,000lb ED Area.

B-2k LOADING AND UNLOADING AREA

Explosive ordnance is unloaded strictly at the ground location at the time designated for the treatment event. Explosive wastes are generally transferred directly from the transfer vehicle to the pit. Procedures to prevent hazards during loading/unloading operations are addressed in Section F, "Procedures to Prevent Hazards".

B-2l FIRE CONTROL FACILITIES

There are no fire control facilities at the 20,000 ED Area. Immediate response fire control equipment, such as fire extinguishers and shovels, are brought to the unit during operations. Base Fire Department capability is available to respond to emergencies should such an event occur. The fire department is notified 24 hours prior to thermal treatment events.

B-2m SURFACE WATERS

Surface water flows in the vicinity of Holloman AFB are generally intermittent in nature. The topographic map provided as Figure B-4 indicates the boundaries for the 100-year and 500-year floodplains are not near the unit. Surface water flow patterns and draws that contain intermittent flow are

further discussed in Section E-2.

B-2n FLOOD CONTROL/DRAINAGE BARRIERS

No structures for the control of flooding or drainage are present at the 20,000lb ED Area. An earthen berm of approximately 2 feet in height surrounds the entire treatment zone and provides some runon control. The unit is elevated sufficiently above the floodplain elevations that flooding potential is considered virtually nonexistent.

B-3 LOCATION INFORMATION

The 20,000lb ED Area is exempt from seismic considerations because the unit is located in Otero County which is not among the political jurisdictions designated in Appendix VI, 40 CFR 265.

B-3a FLOODPLAIN STANDARD

The 20,000lb ED Area is not located within the 100-year or 500-year floodplains of intermittent. The 100-year and 500-year floodplains are designated in the topographic map provided as Figure B-4. Additional information related to surface drainage patterns is provided in Section E-2, “Surface Media Assessment”.

B-4 TRAFFIC INFORMATION

Access to the 20,000lb ED Area unit is provided by a single paved road. A dirt road provides access from paved road to the excavated pits. The pits are approximately on quarter mile from the paved road.

Traffic along this route is restricted to official use of the EOD personnel during explosive operations, but may be accessed by Test Track personnel who are needed during operations.

As a result of these restrictions, the typical traffic volume and pattern consist of a maximum of several vehicles per day that are in transit to or from the unit. The precautions taken to ensure safe transport of the waste to the unit are described in Sections D and F.

B-4a ACCESS ROAD SURFACE

The single access road to the unit designated in Figure B-3 is a paved surface. This surface is periodically maintained to prevent formation of holes, ditches, or other deformation that would increase the possibility of accidental detonation during transport.

B-4b LOAD-BEARING CAPACITY

The paved service road was graded and compacted to provide capacity for automobiles, light trucks, heavy trucks, and service vehicles.

SECTION C

WASTE CHARACTERISTICS

This section describes the physical and chemical characteristics of the waste that is thermally treated at the 20,000lb ED Area. The waste analysis plan that identifies sampling and analytical protocols is provided in Section C-2.

The 20,000lb ED Area consists of a cleared area with two pits which are excavated within this zone in order to thermally treat waste-propellant devices. The wastes that are treated in these excavations are considered characteristically hazardous on the basis of reactivity (D003). During treatment, a pit is partially filled with subject waste. Detonation charges that consist of cyclotrimethylene trinitramine (RDX) explosive are added to the pile in order to detonate the waste. The detonation reaction renders the explosive wastes nonreactive and results in both solid and gaseous by-products. Depending upon combustion conditions, the gaseous by-products will consist of carbon monoxide (CO), carbon dioxide (CO_2), water (H_2O), nitrogen (N_2), and various nitrogen oxides (NO_x). Solid by-products include casings from the waste and possibly trace concentrations of incompletely oxidized reactive material. Reaction by-products that are solid will be retained in the pit (except for ejected components), but the gaseous reaction by-products are allowed to vent to the atmosphere. Due to the difficulties and obvious hazards associated with collection of gas samples in the immediate vicinity of the detonation zone, this plan does not address the gas phase reaction by-products. An assessment of the gaseous constituents released during combustion is provided in a Section E-3.

C-1 CHEMICAL AND PHYSICAL ANALYSIS

The wastes that are treated in the 20,000lb ED Area are generally propellant devices. Only rocket motors that exceed the mass limit at the 300lb treatment area are regularly treated at the 20,000lb ED Area. Similar constituents are used in the formulation of the different items, but the quantity of specific energetic materials varies. In addition to the energetic material, the waste consists of the unit metallic components associated with these devices such as the casing. The total mass of the energetic material in typically limited to less than 1000 pounds per device. The energetic materials contained in these wastes are considered characteristically hazardous on the basis of reactivity (D003) or ignitability (D001). Nitroglycerin (P081) is listed on the basis of its reactivity. The reactive wastes are identified as such because these materials are explosives that deflagrate or detonate when subjected to shock or heat. The ignitable components of these wastes are strong oxidizers.

Single-base propellants contain nitrocellulose (with 12.5-13% N) as the primary constituent. In addition to nitrocellulose, single-base propellants contain organic nitro compounds, stabilizers, and metal salts. The organic nitrocompounds commonly employed in single-base systems include trinitrotoluene and dinitrotoluene. Organic nitro compounds are utilized to disperse the nitrocellulose as colloidal particles. Stabilizers are required in the composition due to the tendency of nitrocellulose to decompose during storage, particularly as moisture is absorbed. Decomposition of nitrocellulose is an exothermic reaction that is indicated initially by an acid odor or condition that progresses to emission of red fumes and spontaneous ignition as the propellant becomes unstable. Due to this condition, nitrocellulose-based propellants are stored in bulk, are vigorously monitored for pH changes, and are compounded with stabilizers used to retard decay. Typical stabilizers used to retard this condition include diphenylamine, nitrodiphenylamine, diethyl diphenylurea, and petroleum jelly (cordite). As decomposition proceeds, nitrophenylamines, nitroureas, and nitroanilines are formed. This variety of the analogs will be present in waste single-based propellants. However, as the original concentration of the stabilizer seldom exceeds 1.0%, the concentration of those decomposition products will be in the parts per thousand range.

In addition to nitrocellulose fuel, nitro-based dispersion agent, and stabilizer certain propellants incorporate small quantities of metal compounds and elements. These compounds include potassium sulfate, tin and graphite that are not characteristically hazardous.

Double-base propellant formulations include both nitrocellulose and nitroglycerin with limited quantities of stabilizers and additives. Nitroglycerin serves as both the gelatinizing agent and a fuel in these compositions. In addition to the nitroglycerin, small quantities of dibutylphthalate, diethyphthalate, or triacetin are compounded to enhance colloidal suspension of the nitrocellulose. The stabilizing agents for double-base compositions do not differ from the stabilizers common to single-base systems. However, the metallic additives for double-bas systems may include barium or potassium nitrate, calcium sulfate, calcium carbonate, or lead stearate in addition to the metallics used in single-base compositions.

The relative concentrations of these components in propellants varies depending upon the intended end use. In general, nitrocellulose is the predominant constituent and is present in concentrations of 50 to 70%. Nitroglycerin is the second largest constituent in the propellant composition. These two compounds constitute greater than 95% of the standard military double-base formulations. The addition of inerts and stabilizers provides the balance to greater than 99% of the formulation, with less than 1.0% of the formulation composed of various nitrates or lead stearate.

Composite propellants consist of ammonium pirate, an inorganic oxidant such as potassium nitrate, and an organic binder. These propellants are heterogeneous solids that may be press formed to the desired shape. Composite formulations are not handled at the 20,000lb ED Area.

Although the term "colloidal suspension" has been applied to propellants, these compositions are completely solid without free liquids. Physically, propellants compositions consist of powders that are incorporated into solid or waxlike binders and pressed into strips, cords, and other linear shapes. although dry nitrocellulose is unstable, incorporation of the binders renders the mixture relatively stable. Propellants, including double-base formulations, are not sensitive to shock and cannot be ignited by ordinary shock or frictional effects. Propellants are sensitive to electric spark only if the material has been finely divided as is present as dust. Thus, propellants present a fire hazard to the degree that a sufficiently strong heat source is available to ignite the composition. Unless finely divided, ignition usually requires either open flame or detonation of a high explosive placed adjacent to the propellant material.

The composition of commonly utilized single-base and double-base propellants is provided in Table C-1. Specific propellants that have been thermally treated at the 20,000lb ED Area are discussed in a future section.

Nitroglycerin has been discussed previously in conjunction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately 13° C. the specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at 20°C. Nitroglycerin decomposes with gas evolution at temperatures of 145°C. The published explosion temperature for nitroglycerin is 222°C, with evolution of approximately 368 Kcal/mol of heat and 715 mL of gas per gram of charge. Nitroglycerin is extremely sensitive to shock, being detonated by a 2 kg weight dropped from a height of 16 cm in the Bureau of Mines reactivity tests. For this reason, nitroglycerin is compounded with other energetics or inerts to facilitate handling. In pure form, it may be absorbed through the skin into the circulatory system and causes increased pulse rate and blood pressure.

Nitrocellulose is a mixture of esters formed by the nitration of cellulose with a mixture of sulfuric and nitric acids. As used in military formulations, nitrocellulose contains a minimum of 12.2% nitrogen. Although nitrocellulose is not truly soluble in any solvent, certain alcohols, ketones, and aromatic nitrocompounds will disperse nitrocellulose as a colloidal suspension. Water has no solvent action upon nitrocellulose but is absorbed to between 2-3% with the resultant deterioration to the unstable form. Cellulose nitrate has a specific gravity` of 1.65. The explosive temperature for cellulose nitrate is approximately 230°C with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal/mol of heat upon detonation that is accompanied by evolution of approximately 700 mL of gas per gram charge. Nitrocellulose is extremely

sensitive to spark ignition if handled in dry form. The shock sensitivity of nitrocellulose is greater than that of nitroglycerin and is listed as detonation by a 2kg weight dropped from a height of 9 cm in the Bureau of Mines test.

C-1a WASTE IN CONTAINERS

Most waste that will be treated at the 20,000lb ED Area will be transported to the treatment area in the original product container. Propellants are contained within chambers that are generally cylindrical in shape and constructed of aluminum and steel. A primary consideration in development of propellant, explosive, or pyrotechnic systems is long-term storage stability which requires compatibility of container and the energetic material.

Receipt of the waste in the product container, combined with the fact that commonly-used military propellants are compatible with one another, ensures the fact incompatible wastes are not mixed. The reactive wastes to be treated at the 20,000lb ED Area are solid in nature and contain no free liquid.

C-1b WASTE IN TANKS --Not Applicable

C-1c WASTE IN PILES --Not applicable

C-1d WASTE IN IMPOUNDMENTS --Not Applicable

C-1e WASTE IN INCINERATORS --Not Applicable

C-1f WASTE IN LANDFILLS

After each treatment event in the 20,000lb ED Area, the residuals are covered with backfill material. The inspection requirements discussed in Section D and the general nature of the waste ensure that residents no longer exhibit the characteristics of ignitability or reactivity. The waste analysis requirements discussed in Section C-2 are designed to ensure that the residuals are not EP toxic, that hazardous constituents are not present at levels of regulatory concern, and confirm that the waste is no longer ignitable or reactive. Residuals that do not meet these criteria are removed from the unit as described in Section D. Thus, the closed trench operates as a solid waste landfill, but is not a land disposal unit for hazardous waste landfill, but is not a land disposal unit for hazardous waste.

C-1g WASTE IN LAND TREATMENT --Not Applicable

C-1h WASTE IN MISCELLANEOUS UNITS

This section addresses the specific wastes that have been treated at the

20,000lb ED Area and are expected to require continued treatment at this unit. The waste characteristics and compositions previously presented in this section were provided to fulfill requirements for a general description of the waste characteristics. The previously provided information also gives background data in the unexpected event that a permit modification is required in order to thermally treat any of the compositions that differ slightly from the waste that have been historically managed.

This section also addresses the characteristics of the waste that must be known for proper management of the waste. This information is derived form published sources. Analysis to support the published data is not required because of the limited deviation allowed within the product specifications that manufacturers of military propellants must follow. The waste that is treated at the 20,000lb ED Area has essentially the same composition as serviceable propellants, but is considered hazardous waste because of shelf-life exceedance, deterioration during storage, or failure to complete exhaust during testing of motors.

In general, the characteristics of the waste that must be known are:

- presence of free liquids,
- basis for hazard designation,
- waste composition,
- ignition or explosion temperature,
- heat of combustion and/or detonation,
- sensitivity to shock or electrical ignition,
- storage stability (tendency to decompose during storage),
- compatibility with container or other energetic material, and
- solubility characteristics.

It must be noted that the unique nature of these materials presents difficulties in development of these data in all instances. In some instances, the parameters are not readily measured because of the instability of the material. For many energetic materials, the particle size, degree of subdivision, compressed density of the material in the ordnance, age, and atmospheric conditions affect the value derived for these parameters. The same material may provide different values for certain parameters for no apparent reason. Thus, the published data presented in this section represents the accepted values for those parameters derived from various tests.

The composition of the propellant devices that have been treated at the 20,000lb ED area, and that are expected to require continued treatment, is provided in Table C-2. Additives to the double-base propellant compositions are also identified in Table C-2. Single-base or composite propellants are not thermally treated at the 20,000lb ED Area. In addition to the specific formulations for the propellants, Table C-2 identifies the components present

in primer compositions or the initial detonating agents associated with these energetic items. The primer is not always treated in conjunction with the propellant. Table C-3 presents data on the characteristics of the constituent used in these propellants. Data on the explosive train (that is a serviceable ordnance and not waste) is also presented in these tables.

Three waste characteristics relevant to proper handling and treatment are not addressed in these tables: (1) the presence of free liquids, (2) compatibility of these wastes with the container, and (3) compatibility with other energetic materials. As previously indicated, the energetic compositions used for these military applications contain no free liquid and consist of finely divided powders or wax-like materials compressed to a variety of shapes. These wastes are managed in the original product container and the materials of the casing were specifically selected at the time of design to be compatible with the energetic material to ensure longevity during storage. Thus, further consideration of these compatibility concerns is not warranted and is prohibitive because of the dangers inherent in any attempt to re-package these materials. Furthermore, these wastes are not re-packaged or stored at the unit. The energetic formulations that are thermally treated at the 20,000lb ED Area are mutually compatible as demonstrated by the fact that these materials are often blended together in a single formulation or conjointly packaged in a single device. In addition to their mutual compatibility, the energetic materials are not removed for blending purposes and, therefore, mixing of incompatible wastes does not occur. Although some limited data concerning reactivity toward water and other reagents are provided in this section, the wastes treated at the 20,000lb ED Area are not mixed with any reagents incidentally or to effect treatment. Such data are provided solely for informational purposes.

The wastes that are treated in the 20,000lb ED Area are characteristically hazardous by reactivity or ignitability. Certain constituents, present in trace amounts, are EP toxic. However, the presence of these constituents does not necessarily render the entire waste material EP toxic. The only waste device that may incorporate EP metals is the detonating squib noted in Tables C-2 and C-3. The primer or detonator used to effect treatment is not a waste.

The shock sensitivity of energetic materials may be determined by the Bureau of Mines impact test. The shock sensitivity data provided in this section are based on the Bureau of Mines method. In practice, this method involves placement of 0.02 gram of the subject material in a brass cup that is subsequently impacted by a 2kg weight dropped from a measurement height. Sensitivity is recorded as the height required to initiate detonation in one of ten tests.

Sensitivity to friction is measured by the pendulum test. In this method,

a specifically weighted bare-metal shoe is attached to a pendulum designed to pass in contact with a grated anvil containing 7.0 grams of energetic materials 18 times during the test. This sensitivity test is utilized less often than impact and is, therefore, not reported.

Heat and electrical spark sensitivity are determined by several techniques. The most reliably reported data are the explosion temperature as determined by submersion of the subject material in a vat of heated bismuth alloy. Both the explosion temperature and any separately noted spark sensitivity data from energetic materials are reported in this section.

C-2 WASTE ANALYSIS PLAN

This section addresses the parameters of concern for waste treated at the 20,000 ED Area. The rationale for the selection of these parameters, sampling methods, analytical protocols, and frequency of analysis are described.

Functionally, the prime constituents are alkoxy nitrates. Inorganic nitrates, chlorates, or peroxides, reactive metals, and inert components (casings and projectiles) are also present. The individual relative components that require treatment are well defines in terms of constituents and are characteristically hazardous by reactivity and/or ignitability . Although certain other constituents are EP toxic in themselves, it is questionable that these components render the entire waste component EP toxic.

The nature of the treatment by-products is dependent upon the category of device from which the waste is derived. Propellant constituents will be converted largely to the gaseous products CO_2, CO, H_2O, N_2, and, to some degree, NOx. Some extremely limited possibility exists that these materials may fail to entirely decompose.

The nitrate oxidant from primers or detonators will convert to sodium or potassium nitrite ($NaNO_2$, KNO_2). Other oxidants are converted to the oxide. Fuels such as antimony sulfide or thiocyanate are converted to the oxide or sulfate.

The sampling and analysis plan outline in this section focuses on solid reaction products because of the hazards associated with plume sampling in the vicinity of the treatment zone. Section E-3 addresses “Air Assessment”.

C-2a(1) Waste analysis will not be performed prior to the treatment of these wastes. Sampling prior to treatment would so greatly increase the potential for accidental detonation, with resultant property damage and personal injury, that such efforts are not warranted. The containers that hold these energetic materials (product or waste) are sealed in accordance with exceedingly specific manufacturing specifications designed to prolong storage stability and reduce

the potential for unplanned detonation or ignition from impact. For example, nitrocellulose propellant mixtures are hygroscopic to 3-4 weight percent if exposed to moist air. The hydrolysis that accompanies exposure of nitrocellulose to air (even at low relative humidity values) renders the material unstable and evolution of NO_2 or auto-combustion occur. Dismantling of the devices (that would be required for sampling) not only increases hazard by exposure of material but increases the potential for detonation due to the friction and shock sensitivity of the materials.

Additionally, the composition of these materials is well defined on the basis of published literature and tightly controlled manufacturing specifications. Thus these materials are analogous to pure discarded commercial products for which sampling would only prove redundant. Prior to treatment of any waste not specifically identifies in Section C-1, a complete listing of all ingredients common to that energetic item will be obtained to determine its suitability for treatment in the 20,000lb ED Area.

The use and handling of these materials is tightly controlled and the device is sealed; therefore, the possibility to mix unspecified items with the energetic materials does not exist. No other wastes are treated in conjunction with these devices in the 20,000lb ED Area because joint treatment is specifically prohibited by Technical orders.

C-2a(2) PARAMETERS AND RATIONALE (POSTDETONATION)

Post treatment analysis of residuals presents less risk to sampling and analytical personnel that attempts to perform predetonation sampling because successful treatment renders the waste non-reactive and non-ignitable. Thermal treatment of propellants converts the alkoxynitrates to gaseous products. The gaseous products will consist primarily of N_2, CO, CO_2, H_2O, and to some degree NO_x. However, because of the difficulties and hazards of gas sampling in the treatment zone, the focus of this plan is the solid residuals that remain in the pit.

The potential solid residues include TCLP metals, the original energetic constituents, decomposition products from the energetic materials, the original inerts and additives, and the decomposition products of the inerts. The TCLP metals result from oxidants present in primers. Decomposition of the oxidants yields the TCLP metals in the form of nitrites, chlorides, and oxides that are expected to remain in the solid treatment residues. Thus, certain TCLP metals were selected as parameters of concern for post-treatment sampling and analyses. However, selection of the entire spectrum of TCLP metals was considered unnecessary because certain of these metals are not present in the input materials. The TCLP metals that result from primer or detonation compositions are Ba or Pb, but are contributed to a limited extent. Certain detonation charges may contain mercury fulminate, although the use of this

compound in ordnance has been largely discontinued in favor of lead azide or styphnate. Antimony sulfide, present in certain primer compositions, was also selected as a parameter of concern.

The energetic materials utilized in propellants or explosives contain highly unstable bonds that are readily ruptured during combustion or detonation. The ready disassociation of these compounds with a resultant high gas volume yield is the rationale for their selection as energetic material. During combustion and detonation of these materials, conversion to elemental gases is essentially complete. Thus, the potential for residues that consist of the original constituent is limited. Poor oxidative conditions exert little influence upon decomposition of those types of materials since a criterion for the selection of these compounds as explosives is a high-oxygen balance. This criterion is imposed to ensure that the decomposition reactions are driven essentially to elemental gases in order to yield the greatest power upon detonation.

The possibility for formation of lower molecular weight analogs of the original species is even less than the potential for unreacted energetic species. Both the high-oxygen balance and inherent bond instability in the molecules contribute to complete disassociation once rupture of the bonds is initiated. For example, carbon-to-carbon bonds have disassociation energies on the order of 100-230 KCal/mol, but the dissociation energies for the carbon-nitrogen bonds in aryl structures is on the order of 50-65 KCal/mol. Thus, the nitro groups are readily released from the molecule. Once fragmentation occurs, the NO_2 radical readily oxidizes the hydrocarbon species to CO, CO_2, and H_2O with the nitro group reduced to elemental nitrogen.

Although the potential for unreacted energetic materials is extremely limited, certain of these were selected as parameters of concern to demonstrate the effectiveness of treatment.

On the basis, RDX, because of its use to initiate detonation, was selected as a parameter of concern. Analysis of the residual for nitrate and organic nitrogen was selected as parameters to measure the completeness of the combustion of nitrocellulose and nitroglycerin that have lower decomposition temperatures than RDX. In addition, the samples will be tested for reactivity to confirm that reactive wastes have been completely treated. Analysis for any lower molecular weight analogs was not considered because of the tendency of the original constituents to totally decompose. Additionally, prediction of such constituents on the basis of thermo-chemistry and reaction kinetics is precluded due to the complexity of the reaction in the detonation.

The inerts that are present in the compositions include the binders and additives. Of these materials, only dinitrotoluene, that is occasionally incorporated in propellants, is considered a hazardous constituent. Although it

is present in a limited number of compositions and expected to decompose under these conditions to NO_x, N_2, CO, H_2O, and CO_2, it was selected for analysis.

The parameters of concern are summarized in Table C-4. These include certain TCLP metals, antimony, RDX, NO_3-N, Total Kjeldahl Nitrogen (TKN), and dinitrotoluene.

C-2b TEST METHODS

Samples of the solid residuals and underlying soils will be prepared and analyzed according to protocols from SW-846, Test Methods for Evaluating Solid Waste, Third Edition. The TCLP metals are prepared by analysis of EP extracts by Method 3010 and Method 3050 for total metals. Mercury is analyzed by cold vaporatomic absorption, Methods 7470 and 7471. If aluminum, chromium, or iron interferences prevent quantification of antimony or lead, these analytes will be quantitated by atomic absorption. TKN is prepared by digestion of the residues or soil in sulfuric acid with the digestrate analyzed by ion selective electrode, colormetric, or titrimetric techniques as specified in Method EPA 351.3 (EPA-600/4-79-020, Methods for chemical Analysis of Water and Wastes.

No approved method exists for the quantification of RDX or reactivity. The method selected for this analysis was liquid chromatography as specified in Journal of Chromatographic science 23:532-4, 1985. The test method selected to determine reactivity was the Bureau of Mines Impact Test. This method was briefly described in Section C-1. The analytical methods for residuals and soils from the pit are outlined in Table C-4 on the following page.

C-2c SAMPLING METHODS

Samples of the treatment residuals and underlying soils will be taken annually to demonstrate the effectiveness of the treatment and to ensure that hazardous wastes are not present. A random sampling methodology will be used to collect representative samples.

Selection of random samples will be facilitated by division of the pit bottom surface into grids. Each grid dimensions will be approximately 3 feet x 3 feet to yield 300-500 grids. Each grid will be successively numbered along the rows until each grid is numbered.

As described in EPA/530-SW-84-012, Waste Analysis Plans--A Guidance Manual, a random number table will be used to select the grids for sampling locations. A description of the use of the random number table for posttreatment and sub-unit closure is provided with the table as Exhibit C-1. The number of samples to be taken is determined by application of ASTM

D140-70, Standard Method of Sampling Bituminous Materials. The selection table from this method is also provided as Exhibit C-1.

This sampling methodology will result in division of each pit bottom surface into approximately 300-500 grids that are considered to represent both surface layer and subsoil residuals. Thus, a total of seven or eight samples of surface residuals and subsoils will be taken.

Soil samples will be taken to a depth of approximately 2 feet with a handheld auger. A minimum of three corings will be taken from the center of each grid and composited in a glass pan that has been precleaned with a soap/water solution and rinsed in deionized water, acetone, and deionized water. Cleaning solution will be brought to the unit to allow cleaning of equipment between each grid sampled. Both the residual and soil samples will be homogenized by the use of a separately dedicated stainless-steel spoon.

After the sample is composited, a quantity of either the residual material or soil will be transferred to two 8-oz, wide-mouth glass jars with teflon-lined screw-type lids that have been precleaned to EPA protocols. One sample jar will be collected for metals and one for organics. A sufficient quantify of samples will be transferred to the container to completely fill the container volume. The sample jar will be tightly closed, taped, and a sample identification/analyitcal request form will be attached to the container. A corresponding chain-of-custody sample log sheet will be completed by the sampler. Both the chain-of-custody log and the sample tag will identify the grid location from which the cample was taken. Solid samples in the field are preserved by placement of the sample container in an ice chest that contains an ice/water mixute.

Table C-4. Parameters of Concern for Treatment Residuals in the 20,000lb ED Area

Parameter	Preparation Method	Analytical Method
Specific EP Metals	1310	1310
Barium	3010,3050	6010
Mercury	7470, 7471	7470, 7471
Lead	3010, 3020, 3050	6010, 7421
Antimony	3020, 3050	6010, 7041
Cyclotrimethylenetrinitramine	LC[a]	L.C.
NO_2 - NO_3	9200	9200
Total Kjeldahl Nitrogen	351.3	351.3
Reactivity	NA[b]	Bureau of Mines Impact Test
Dinitrotoluene	3540, 3550	8250

[a] L.C. = liquid chromatography
[b] NA = not applicable

C-2d FREQUENCY OF ANALYSIS

Sampling, as specified in Section C-2(C) and the corresponding analysis indicated in Section C-2(b), will be performed annually. Although historically only about six detonations are performed each year, this frequency was selected to ensure effectiveness of treatment and prevent storage of hazardous waste in the area.

EXHIBIT C-1

SELECTION OF RANDOM SAMPLES

EXHIBIT C-1

SELECTION OF RANDOM SAMPLES

The random number table included to this exhibit is used in the following manner:

1. The sampler proceeds to the row that corresponds to the month of the sampling event.

2. The sets of numbers are followed across the selected row until the sets that correspond with the date of the sampling event are reached.

3. The counting location within the grid selected by the preceding steps is selected by counting horizontally and vertically to the digit occupied by the last tow digits of the present year. For 1988, the starting location is identifies as the 8th column in the grid and the 8th row of the grid. Rows 1-5 are in the first set of digits and rows 6-10 are the second set of digits. For a sampling event on 10/14/88, the beginning number in the identified grid is "2".

4. Proceeding left to right, each set of two digits (i.e., 24, 88, 35, 33, 25,44, 01, 78, 03, ect.) are selected. Values larger than the sample population are discarded. For trench sampling with 30 cells, the locations would be grids 24, 25, and 01 If both residuals and soils are taken, the sample locations are grids 24, 25, and 01. Grids 03, 18, and 05 will be sampled for soils. If a value is repeated (i.e., 18, 18), the value is used only once.

The following table is from ASTM D140-70 and is used for selection of the required number of samples in dry unconsolidated materials. An example of grid numbering for both residuals and soils is provided on the following pages.

SECTION D

PROCESS INFORMATION

D-1 CONTAINERS -- Not Applicable

D-2 TANKS -- Not Applicable

D-3 WASTE PILES -- Not Applicable

D-4 SURFACE IMPOUNDMENTS -- Not Applicable

D-5 INCINERATORS -- Not Applicable

D-6 LANDFILLS -- Not Applicable

D-7 LAND TREATMENT -- Not Applicable

D-8 MISCELLANEOUS UNITS

The 20,000lb ED Area provides treatment to waste propellant items that are considered to be characteristically hazardous on the basis of reactivity or ignitability. The unit consists of a cleared circular area approximately 1600 feet in diameter that is encircled by and approximately 2 to 3 foot earthen berm. Within this cleared area, a pit that is approximately 20 to 30 feet in diameter is excavated to a depth of approximately 10 feet. The subject reactive wastes are placed in the pit, and RDX charges are attached. During treatment, the initial RDX detonation results in rupture of the propellant casing that allows detonation of the contents to occur. After the detonation, the EOD personnel inspect the pit contents to ensure that all reactive materials have been destroyed.

D-8a TYPE AND QUANTITY OF WASTE

Types of waste that have previously been treated in the 20,000lb ED Area were identified in Section C-1. These wastes may be summarized as propellent that consists primarily of nitrocellulose and nitroglycerin.

RDX charges in the form of an explosive train are used to initiate detonation. The charge, primer, and detonator are not waste items when used in this fashion. The total mass limit per treatment event is 20,000 pounds of these waste devices. Propellant devices typically contain a larger percentage of energetic material per total mass than do explosive items. The percentage of energetic material in propellant devices is estimated to range from 40 to 50% of

the total mass. The remainder of the mass of these items is present as the casings or canister that holds the energetic material. Thus, for any given treatment event, the total quantity of energetic material will be less than 8,000 to 10,000 pounds. The nature of the generating process (shelf-life exceedance, failure to exhaust during use, etc.) prohibits strict specification of the total mass of the energetic material present in the pit for any discrete treatment event, although it is probable that the total energetic mass seldom exceeds 10,000 pounds. Thus, it is estimated that the total mass of energetic material annually treated in the 20,000 ED Area seldom exceeds 50, 000 pounds.

D-8b(1) LINER EXEMPTION

Recently promulgated 40 CFR 264.601 standards for miscellaneous units indicate that "permits, terms and provisions shall include those requirements of Subparts I through 0" of Part 264 that are appropriate to the miscellaneous unit being permitted. Under RCRA standards, all land-based units, with the exception of land treatment, are required to provide line systems in the design unless exempted from this requirement. A request for exemption from the application of any liner standards is submitted.

D-8b EXEMPTION BASED ON EXISTING PORTION

An exemption on the basis that the 20,000 ED Area existing portion of a land-disposed unit is not requested. The 20,000 ED Area does not provide land disposal of hazardous waste, but is utilized for the purpose of treatment and renders the waste nonhazardous in nature.

D-8b(2) EXEMPTION BASED ON ALTERNATIVE DESIGN, LOCATION, AND OPERATING CHARACTERISTICS

An exemption from application of liner standards is requested on the basis of alternative design, location, and operating characteristics. The combined effect of these factors is to significantly reduce the potential for migration of any hazardous constituent from the unit.

D-8b(2)(a) ALTERNATIVE DESIGN

The design considerations that are pertinent to this request are:

(1) Installation of any liner system is impractical for the conditions that are experience during thermal treatment.

(2) Thermal treatment renders the waste nonreactive and nonnegotiable. Posttreatment sampling and the management practices for residuals combine to ensure that hazardous wastes are not disposed of in the trench.

The first design consideration that supports the request for exemption

from application of liner standards results from the impracticality of liner placement in or near the treatment zones. Placement of any form of liner material directly beneath the waste is prohibited because it would be destroyed.

Theoretical calculations based upon estimated products of combustion indicate that temperatures in the treatment zone will range from 2100°C to 3200°C. Thus, any FML type material that was placed directly beneath the waste would be destroyed. Furthermore, concrete could note serve as a liner material because detonation during treatment would result in its fragmentation.

During detonation, fragmentation of the ordinance casings occurs as heat input to the item causes pressure to increase within the casings. Upon rupture , fragments of the casing are eject in all directions with great velocity. The impact of these fragments upon any liner material would destroy the containment integrity even if it is assumed that the liner could withstand the temperatures.

Placement of a liner at some depth below the treatment zone is not practical since the posttreatment crater extends to depths of approximately 30 to 40 feet. This considerations indicates the need for such a separation between any possible liner and detonation zone that the value of the liner would be questionable.

Exemption from application of liner standards is support on the basis that the 20,000lb ED Area functions as a thermal treatment unit and does not provide for disposal of hazardous waste. Waste that are input to the ED Area are considered characteristically hazardous on the basis of reactivity or ignitability. Posttreatment inspections of the residuals is designed to ensure that reactive fragments do not exist. Furthermore, annual sampling and analysis is performed to confirm that the residuals and underlying soils do not exhibit any of the characteristics of hazardous waste.

Conjunctive treatment nonordnance type waste (i.e., solvents) is prohibited by Technical Order (TO) 11A-1-42 and Holloman AFB Regulation 125-2. Thus, the only listed wasted placed for treatment is nitroglycerin (P081). The detonation train may contain lead azide, lead styphnate, or mercury fulminate in addition to the RDX charge, but these are not waste items. Mercury fulminate is rarely used because of its extreme instability. In these limited number of primers that may contain mercury fulminate, the total mass of this compound is less than 0.24 grams.

Posttreatment sampling of the residues is designed to confirm that the residuals are not reactive in nature. The parameters for extraction procedure (EP) toxicity, NO_2-NO_3, and TKN are indicated in the posttreatment analytical

protocols to confirm that the residual no longer exhibits the characteristics for which these wastes were listed. Residuals that exhibit the characteristic of EP toxicity or reactivity are removed from the unit prior to its posttreatment coverage with active soils.

Additionally, the sampling protocols are designed to ensure that additional hazardous constituents are not present in the residuals. The additional hazardous constituents that may be present include dinitrotoluene, tetracene, and antimony based compounds.

Although some potential exists for dinitrotoluene enter the trench for treatment, this constituent does not meet the listing criteria for discarded commercial products or products in which the listed constituent is the sole active ingredient. Tetrecene (a nitrosamine-based compound) and antimony sulfide meet only the not otherwise specified (NOS) criteria for hazardous constituents and are not specifically listed. Under the conditions of the thermal treatment, the organic constituents are oxidized to CO, CO_2, N_2, NO_x, H_2O, and are not expected to remain in the residuals. The posttreatment protocols are designed to confirm the destruction of these constituents and ensure that these compounds are not present at the time of subunit closure.

D-8b(2)(b) LOCATION

The location considerations pertinent to the request for exemption from application of liner standards are:

1. The 20,000lb ED Area is located in an area with limited precipitation.
2. The net aquifer recharge rate in the area is negative.
3. The uppermost aquifer is of insufficient quality for use as a potable water supply.

The Tularosa Basin climate is arid with exceptionally low precipitation and low relative humidity. Over a period of 44 years, the average annual precipitation was 8.3 inches. The peak monthly precipitation during this time was 4.5 inches and the maximum 24-hour event for the 44-year period was 2.1 inches.

The mean annual lake evaporation, commonly used to estimate evapotranspiration and aquifer recharge is 67 inches per year. Thus, the annual net precipitation is -59 inches per year and recharge rates to the uppermost aquifer are limited. Additionally, the potential contribution of runon/runoff to contaminant transport is limited because theTularosa Basin is closed with respect to surface water flows. The limited surface water drainage that occurs within the base is controlled by intermittent streams and arroyos. The 20,000lb ED Area, located in the more elevated portions of the base, is approximately 50 to 100 feet above the main base. No intermittent streams are

nearby. Runon that might contribute to contaminant transport is excluded by an earthen berm of approximately 2 to 3 feet in height. Thus, the potential for contaminant transport by surface water is limited.

The depth to the water table is reported as <10 feet in the southern portions of the base. It is considered probable that the water table is at >10 foot depths below the 20,000lb ED Area because the area's surface elevation ranges from approximately 50 to 100 feet above the areas reported to have water table depths of 10 feet. This conclusion is supported by historical evidence that water has never been encountered during treatment.

It should be noted that the underlying aquifer is naturally high in sulfite and chloride salts (>10,000 ppm). These concentrations render the aquifer useless as a potable water supply. Thus, any unlikely contaminant transport to groundwaters from the 20,000lb ED Area would not result in impacts to drinking water supplies. A future section further describes the hydrogeological factors pertinent to the 20,000lb ED Area and further addresses the potential for contaminant transport.

D-8b(2)(c) OPERATING CHARACTERISTICS

The operating characteristics pertinent to the request for exemption from application of liner standards are:

1. The 20,000lb ED Area provides thermal treatment to wastes that are hazardous primarily due to reactivity. Treatment of these wastes yields nonhazardous residues; thus, no disposal of hazardous waste is performed.

2. Treatment events are not conducted during precipitation events or if such event is imminent.

3. No free liquids are treated in the unit. Accumulation of free liquids within the residuals contained in the trench is prevented by the pit operation.

4. Runon is unlikely to enter the pit because of the limited annual precipitation.

5. Residuals are nonhazardous in nature. Organic constituents are converted to gaseous products during treatment. EP metal constituents are present in either elemental states or as oxides that are of limited solubility.

6. Annual inspections and sampling are designed to identify the presence of any unreacted hazardous waste or hazardous constituents. Treatment is repeated if unreacted wastes are found in the trench.

Residuals are removed if sampling reveals EP toxicity or unacceptable concentrations of hazardous constituents.

Section D-8b(1) discussed the operation of the 20,000lb ED Area as a thermal treatment unit and indicated that hazardous waste is not disposed of in the trench.

The TO (TO 11A-1-42) Holloman AFB regulations govern operations at the 20,000lb ED Area. Thermal treatment operations are conducted only during weather conditions that are identified as excellent or fair in Table 1-1 of the technical order indicated as Exhibit D-1. In general, these conditions allow treatment events only at specified daytime conditions of:

(1) wind speed 3-15 miles per hour,
(2) temperature >55°F, and
(3) clear or partly cloudy skies.

Thermal treatment is not performed during precipitation events. If partly cloudy skies exist, the base meterological division is contacted to ensure that precipitation is not imminent. The waste that are treated in the unit contain no free liquids.

The organic constituents of the initial charge are converted to gases during treatment. The distribution of expected gas products from treatment is indicated in Section E-3. During treatment, the oxidant portion of the C-4 detonators (which is the primary potential source of EP metals) is reduced to the elemental form or the oxide as indicated in a previous section. Barium oxide from the nitrate in the priming charge is soluble to the extent of approximately 3.5%. Lead oxide (possibly from primers or detonators) is soluble to the limited extent of approximately 20 mg/L. Antimony and mercury oxides exhibit solubility similar to the oxide of lead. In general, detonators that are the primary potential source for lead or mercury are less than 1.0 gram in mass.

The final operating characteristics consideration is management of residuals to ensure that hazardous wastes are not closed in place at the time of placing the soil cover. Residuals management involves inspections to ensure that all items placed in the pit are destroyed, annual sampling, and removal of residuals that are characteristically hazardous. Inspection requirements and residuals management are further defined in Sections D-8d and F. Posttreatment sampling was discussed in Section C

D-8b(3) GROUNDWATER MONITORING EXEMPTION

A request for exemption from application of groundwater monitoring standards is submitted. This request is based upon consideration of the factors listed below.

(1) The 20,000 ED Area operates as a thermal treatment unit and the activities conducted at this unit are not considered disposal of hazardous waste. Residuals are inspected and sampled to confirm the effectiveness of treatment. Sampling is also designed to ensure that subsoils are not contaminated. Residuals that exhibit hazardous waste characteristics or contaminated soils are removed from the unit.

(2) The groundwater monitoring requirements are defined as waste piles and treatment units, surface impoundments, and landfills that receive hazardous waste after July 26, 1982. No specific groundwater monitoring requirements are applied to miscellaneous units regulated under 40 CER 264, Subpart X. Sampling protocols of Section C are intended to ensure that operation as a regulated unit does not occur.

(3) The design considerations and operating practices relative to this unit, discussed in the preceding section, indicate that the potential for migrations of constituents is limited. In particular, the factors that limit the potential for migration are:

- no free liquids are treated;
- construction of the drainage ditch in the trench prevents contact with runon and limited precipitation that might occur;
- the mobility of the potential constituents in the residuals is limited. Organics are translated to gas products as discussed in the Section E-3. Of the oxides from primary or detonating charges, (P) or (SbO) have solubilities of less than 20 mg/L and only BaO has appreciable solubility.

(4) As described in Section E-1, the location characteristics of the unit indicate the potential for migration is very limited.

D-8c DESIGN AND CONSTRUCTION

The 20,000lb ED Area consist of any approximately 1680 foot diameter explosive zone area in which approximately 40 t0 60 feet diameter by 10 feet deep pits are alternately developed. Access to this area is provided by a single paved road that terminates at the end the Test Track. A dirt road of approximately one quarter mile is used for access from the paved road to the pit. The unit is used for thermal destruction of wasted propellant devices. A total mass limit of 20,000 pounds of waste propellant (including inert casings, etc.) is established for the unit.

D-8c(1) SPECIFICATIONS

Treatment of waste propellant is facilitated by excavation of an

approximately 40 to 60 foot diameter pit within the cleared area. The pit is opened, used for thermal treatment, and covered with original soil. Subsequent treatment events are performed by development of excavation in the same location in the same fashion. To limit treatment amount in a single pit, and therefore enhance safety, two pits may be operable at one time. If two pits are used the combined mass of the waste will not exceed 20,000lb.

Construction of the thermal treatment pit is initiated by submission of a work order from, the EOD office to Holloman AFB Civil Engineering. This work order specifies the general dimensions of the pit, its location, and anticipated date of use. Actual excavation is performed by civil engineering personnel accompanied by EOD specialists. During pit excavation operations, no energetic items are located in the 20,000lb ED Area. Pit excavations are mad with standard earth-moving equipment (backhoe) operated by personnel trained and certified in its use. Similar considerations apply to backfilling operations after treatment events

The dimensions of either of the initial excavations is approximately 40 to 60 feet diameter by a depth of approximately 10 to 12 feet. The excavation is developed with sufficient sidewall slope to ensure stability. Although these gypsum sands are sufficiently concretious in nature to allow sidewalls to be constructed at almost 90° general safety standards dictate sidewall slopes of approximately 2:1 (60°). During treatment, the detonation force widens the trench to a diameter of approximately 70 to 90 feet and a depth of approximately 30 to 40 feet.

During excavation, soil removed from the trench zone is placed away from the pit. The soil pile is separate from the excavation in order to prevent loose material from reentering the excavation and to prevent any runoff from the soil pile from entering the trench during its active life. During development of the excavation, the trench bottom is lightly compacted to provide suitable foundation for operations.

Treatment is performed in two designate pit locations, residuals are inspected and sampling is performed annually. Upon return of analytical results that indicate a lack of contamination, the pit is continued to be used. The interim cover is intended to further reduce the limited potential for migration of waste or constituents during periods between treatment events. Treatments are restricted during the time between sampling and analytical results. Upon receipt of verification that contamination does not exist, the subunit is cleared for treatments. Residuals management is further addressed in Section D-8d.

D-8c(2) PROTECTION FROM PRECIPITATION

Protection from precipitation is provided to waste prior to and during

treatment events by operating constraints that prohibit thermal treatment during precipitation events. Thermal treatment is also prohibited if such events are imminent. After completion of the treatment event, residuals that remain in the trench are protected from precipitation by the arid climate and backfill procedures discussed earlier.

D-8c(3) RUNON CONTROLS

Several natural factors contribute to a limited potential for runon to enter the unit during the posttreatment period or prior to use of a recently opened unit. These factors include the limited precipitation received in the area, the moderate soil permeability that aids surface water infiltration, the limited relief present in the pit area, the pit area elevation relative to the surrounding area, and the high evaporative flux present in the region. Although these factors severely restrict the potential for runon entering a subunit prior to use or after a thermal treatment event, several safety factors have been incorporated into the 20,000lb ED Area design and operation. The entire area is surrounded by an approximately 2 t0 3 foot high earthen berm that restricts entry of runon from adjacent areas of higher elevation. Soils from the excavation are separated from the pit opening to prevent runoff from the pile from entering the trench prior to treatment events. Finally, if precipitation occurs during the interim between trench excavation and precipitation occurs during the interim between trench excavation and treatment, the pit is not used until any standing liquids have dissipated.

D-8c(4) WIND DISPERSAL CONTROLS

The average annual wind speed in the region is approximately 5.7 miles per hour and the maximum monthly average wind speed is approximately 7 miles per hour. These values indicate limited potential for wind-based dispersion of treatment residuals. For these wind speed values, the fact that the residuals are located from approximately 30 to 40 feet below surface will prove sufficient to control wind dispersal. The maximum wind speed value for the 44-year period ending in August 1986 was approximately 80 miles per hour. If gale-force winds or wind speeds in excess of 15 miles per hour appear imminent, treatment will be postponed (see Section D-8d(1).

D-8c(5) SUBSURFACE DATA/SLOPE STABILITY

Subsurface data relevant to contaminant transport in the unsaturated or saturated zones is provided in Section E-1. Four soil horizons are traversed in the pit depth with the upper approximately 1 foot of soils being predominantly sands that are slightly sticky and nonplastic in nature. Below the 1-foot depth, the soils consist of gypsum that demonstrates transition from non-sticky nonplastic, and moist soil (approximately 20 inches) to gypsum soils that are slightly plastic, slightly sticky, hard, and somewhat friable. Geotechnical data,

such as Atterberg limits, unconfined compression, direct shear strength or triaxial compression are not available. Therefore, to ensure slope stability of trench sidewalls, an approximate 2:1 slope is used for construction of the trench.

D-8c(6) SETTLEMENT POTENTIAL/LOAD-BEARING CAPACITY

The subunits are marked to designate their location after backfilling. Waste transport vehicles do not traverse the surface of the trenches, and the capacity for this type of vehicle is not required. The only equipment that traverses the unit surface is earth-moving equipment required for excavation. The load-bearing capacity of the backfilled subunit is essentially equivalent to that of the unconsolidated materials present in the other undeveloped portion of the base. This capacity is sufficient to support light earth-moving equipment.

Limited subsidence occurs in the subunits because the void volume is relatively unaffected by treatment operations. After treatment, the cover and backfill consist largely of the initially removed soil. The ash residues comprise only a limited portion of the fill. However, to retard wind erosion reduce infiltration, and limit subsidence, the top layer in the cover will consist of mixed soils mounded slightly above the surface and compacted by five blade passes. Settlement of such a cover is not expected to occur, but any limited subsidence will be replaced by natural action of wind-borne soil motion.

D-8c(7) RUNOFF CONTROLS

The depressed nature of the pit excavation indicates that the potential for runoff contaminated with residuals from the unit is essentially nonexistent Residuals from the trench are not brought to surface level at any time during the operation except for removal and disposal as hazardous waste (if required)..The natural factors (limited relief, moderate soil permeability, low precipitation that contribute to the limited potential for runon entering the unit also limit runoff from the clear zone. Therefore, no runoff controls are applied at the unit.

D-8c(8) DISTANCE REQUIREMENT

Interim status standards for thermal treatment units that provide detonation of waste explosives and propellant mixtures specify certain minimum distance requirements. These distance are based upon actual poundage of waste explosives present in the unit. Although the actual mass of energetic material present in the 20,000lb ED Area operations is unknown, it is expected to be less than 10,000 pounds. For this mass of energetics, the required distance to buildings or adjacent property is 1730 feet (530 m). The clear zone boundary (no unauthorized entry, structures, etc.) is specified as 1680 feet from the 20,000lb ED Area. The nearest building is located approximately 1750 feet from the 20,000lb ED Area.

D-8d TREATMENT PROCESS

The 20,000lb ED Area provides thermal treatment to waste propellant identified as hazardous waste due to ignitability or reactivity, Certain constituents that may be present in these wastes are considered EP toxic or Appendix VIII hazardous constituents. Thermal treatment is facilitated by excavation of a pit that is used for a single detonation limited to a total mass of 20,000 pounds.

D-8d(1) PROCESS DESCRIPTION/OPERATING PRACTICES

Operational procedures at the 20,000lb ED Area are governed by TO 11A-1-42 and Holloman AFB Regulation 136-2. These orders specify certain atmospheric conditions for treatment operations. In summary, these conditions are:

- temperature: general (>55°F); winter (not specified);
- wind speed: general (4 to 15 miles per hour); winter (7 to 15 miles per hour;
- precipitation: no treatments allowed;
- cloud cover: none or limited; and
- time: 0800 to 1800 hours.

The climatic conditions at Holloman AFB generally allow detonation to be conducted under conditions specified as "excellent" in TO 11A-1-42 (Exhibit D-3).

Personnel who perform operations in the 20,000 ED Area are specifically EOD-trained staff members. The total number of EOD personnel is limited to those required to perform the operation. A minimum of two personnel are which is an EOD supervisor, is required for all operations. These personnel are provided both initial training at the Indian Head, MD, school for ordnance and also receive annual reviews concerning ordnance items and RCRA requirements. Section H outlines required training. During all operations, the EOD supervisor operates as the range manager and controls initiation of the thermal treatment. Prior to initiation of the treatment event, all other EOD personnel are required to move and take cover south of the 20,000lb ED Area outside the danger area.

Several efforts are performed prior to the thermal treatment event. All waste energetic items destined for treatment are inspected, logged, and accounted for prior to removal from stock or other designation as waste. It should be noted that these items become waste primarily through shelf-life exceedance or inequalities noted during inspections of serviceable items. A complete inventory of items to be treated is compiled on the advance disposal

request which requires HQ approval before treatment can proceed. Additionally, an inventory of items to be treated is recorded on the EOD Report (AFTO 358), included as Exhibit D-2. Prior to the scheduled treatment event, the EOD supervisor notifies the following base agencies:

- meteorological service (for imminent weather conditions).
- munitions control
- base medical service,
- security police,
- base operations,
- base fire chief (the IOSC if emergency occurs), and
- base environmental coordinator.

The waste energetic items are transported in accordance with TO 11A-1-60 and other relevant orders. Prior to transport, the EOD supervisor brief all member of the team on hazards associated with specific items, pertinent technical data technical orders, specified treatment procedures, safety precautions, and transport procedures. Upon arrival at the unit, all waste energetic items are inspected and accounted for by comparison with the previously prepared inventory. During transport and operations, all nearby road are cleared, posted, and maintained free of traffic.

To limit the potential for incidental detonations, all removal primer and detonating items are removed from the waste energetic items. No attempt is made to remove these items if they are integral parts of the device.

The actual treatment is facilitated by placement of the waste items in the excavation and attachment of C-4 (RDX) donor charges to the waste item. An "explosive train" is constructed and detonation is initiated from the bunker located in the clear zone. The donor device consists of a series of components that are referred to as an explosive train once the individual devices are placed in combination. An explosive train consists of a primer, and initial detonating agent, and a high explosive is achieved by step-wise detonating of the proceeding components.

Primers compose an extremely small portion of total explosive train and are present in the device in quantities of 0.04 to 0.2 grams of energetic material.

Primary compositions are mixtures of finely-divided powders of various salts. An oxidant fuel and explosive are combined in the primary composition. Typical oxidant are barium nitrate and potassium chlorate. Fuels in the priming mixture are present in an amount equal to the oxidant (approximately 30%) and are one or more of the following compounds: lead thiocyanate, antimony sulfide, or calcium silicide. The explosive charge constitutes from 5 to 30% of mixture and is highly explosive in nature. Common explosive used

in primers are lead azide, lead styphnate, and diazodinitrophenol (DDNP). If the explosive train operates without the use of the initial detonating charge, the explosive in the primer will consist of trinitrotoluene or pentaerythrite tetranitrate (PETN). The remainder of the primer composition consists of inert binders (gum arabic, wax, etc.).

The initial detonating agent for munitions or ordnance consists of a small charge of compressed high explosive. These agents are compounded to have stability to shock or heat that is intermediate between the very sensitive primer and the less sensitive high explosive charge. This charge consist of relatively pure (<99%) explosive similar to that used in the primer composition. The compounds typically utilized as the initial detonating agent include lead azide, lead styphnate, DDNP and tetracene. The total mass of the initial detonating charge is also small and usually consists of less than 100 gram of the agent.

High explosives may be segregated into four classes that are defined as single-compound explosive, binary explosives, plastic explosives, and dynamites. All four categories of explosives are based upon a limited group of energetic materials that are either compounded together (binary explosives) or mixed with inert binders (plastic explosives and dynamties).

Of the approximately 20 compounds that may be used for this purpose, the wastes that are thermally treated at the 20,000lb ED Area use a very limited number of energetic materials. These materials include: nitroglycerin, nitrocellulose, trinitrotoluene (TNT), PETN, trinitrophenylmethylnitramine (tetryl), cyclotrimethylene (RDX), and cyclotetramethylenete tranitramine (HMX)).

Many binary explosives are formulated from the components listed above. For example, cyclotol is a mixture of RDX and TNT, octal refers to mixtures of HMX and TNT, and pentolite refers to mixtures of PETN and RDX. None of the binary explosives are thermally treated in the 20,000 ED Area

Plastic explosives are formulated by blending certain explosives listed above with binders, waxes, and oils. The energetic materials most commonly used for plastic explosives are RDX, TNT, and nitrocellulose. Certain waste munitions thermally treated at the 20,000lb ED Area incorporate the energetic material's plastic explosive.

Nitroglycerin has been discussed previously in conjuction with propellants. In pure form, nitroglycerin is a colorless liquid with a molecular weight of 227 that fuses to the solid state at approximately 13°C. The specific gravity of nitroglycerin is 1.596^{20} and the liquid viscosity is 36 centipoise at 20°C. Nitroglycerin decomposes with gas evolution at temperatures of 145°C. The published explosion temperature for nitroglycerin is 222° with evolution of approximately 368 Kcal/mol of heat and 715 ml of gas per gram of charge.

Nitroglycerin is extremely sensitive to shock, being detonated by a 2 kg weight dropped from a height of 16 cm in the Bureau of Mines reactivity tests. for this reason, nitroglycerin is compounded with other energetics or inerts to facilitate handling. In pure form, it may be absorbed through the skin into the circulatory system and cause increased pulse rate and blood pressure.

Nitrocellulose is a mixture of esters formed by the nitration of cellulose with a mixture of sulfuric and nitric acids. As used in military formulations, nitrocellulose contains a minimum of 12.2% nitrogen. Although nitrocellulose is not truly soluble in any solvent, certain alcohols, ketones, and aromatic nitro compounds will disperse nitrocellulose as colloidal suspension. Water has no solvent action upon nitrocellulose but is absorbed to between 2 to 3% with the resultant deterioration to the unstable form. Cellulose nitrate has specific gravity of 1.65. The explosive temperature for cellulose nitrate is approximately 230° with evolution of 661 Kcal/mol of heat upon combustion or 272 Kcal mol of heat upon detonation that is accompanied by evolution of approximately 700mL of gas per gram charge. Nitrocellulose is extremely sensitive to spark ignition if handled in dry form. The shock sensitivity of nitrocellulose is greater than that of nitroglycerin and is listed as detonation by a 2 kg weight dropped from a height of 9 cm in the Bureau of Mines test.

TNT is available in six isomeric forms although 2,4,6-TNT is the form most commonly utilized. Pure TNT fuses at 80.7°C, has a specific gravity of 1.65, and liquid viscosity of 13.9 CP at 85°C. TNT is among the least sensitive of military explosives, requiring an 85-cm height for detonation by 2 kg weight in the Bureau of Mines test. In addition, TNT has a very high explosion temperature (475°C) and is sensitive to electrical spark only if finely divided. Upon detonation, TNT 245 Kcal/mol of heat and 730 mL of gas per gram of charge. The heat of combustion of TNT is 821 Kcal/mo. TNT derives its value largely from its stability during storage and the ability to melt cast components.

PETN is an aliphatic nitrate formed by the nitration of pentaerythritol [$C(CH_2OH)_4$]. Highly purified PETN melts at 141°C and has a crystal density of 1.76. The heat of combustion of PETN is 600 Kcal/mol. Upon detonation at 215°C, PETN YIELDS 439 Kcal/MOL OF HEAT AND 790 ML OF GRAS PER GRAM OF CHARGE. PETN has an impact sensitivity similar to nitroglycerin (17cm) but is not sensitive to electrical detonation.

Tetryl, (2,4,6-trinitrophenylmethylnitramine) is an nitro derivative of methylsubstituted picramide (trinitroaniline) that is formed by nitration dimethlyaniline. Pure tetryl melts at 130°C and has a crystal density of 1.73. Tetryl yields 324 Kcal/mol of heat with expulsion of 760mL of gas per gram at its explosion temperature of 257°C. The heat combustion of tetryl is 840 Kcal/mol. Tetryl is less sensitive to impact than nitroglycerin but is greater sensitivity than TNT with detonation occurring with a 2 kg weight dropped from height of 26 cm in the Bureau of Mines test. Tetryl is toxic if inhaled with a recommended permissible exposure level (PEL) of 1.5 mg/m^3.

Cyclotrimethylene trinitramine (RDX) OR TU is a colorless solid that melts at 204° and has a crystal density of 1.82. Impact tests show RDX to be of similar sensitivity to tetryl with detonation occurring at 32cm. RDX is the second most powerful military explosive with greater power than tetryl or PETN and nearly equivalent power to nitroglycerin. The heat of detonation from RDX is 285 Kcal/mol with formation of 908mL gas per gram charge. The stability of RDX is similar to that of TNT.

HMX is formed during synthesis of RDX. In pure form, HMX has a crystal density of 1.87 and a fusion temperature of 276° The heat of combustion of HMX is 660 Kcal/mol and the heat of explosion is 390 Kcal/mol. The explosion temperature of HMX (337°C) is greater than RDK but HMX is of equivalent power to RDX upon detonation, yielding approximately 810 mL of gas per gram of charge. HMX is of limited toxicity as is RDX. Unlike RDX, the tetranitramine is seldom used in single compositions but is more commonly blended with TNT under the name Octol. The high explosive device used to detonate these waste items is composition C-4. This high explosive consists of approximately 90% RDX and 10% polyisobutylene.

Inspection of the residuals is performed as soon as the detonation has occurred. Furthermore, the surrounding area is thoroughly inspected to find any ordnance that may have ejected from the unit. If any untreated energetic device is found, treatment is repeated.

D-8d(2) EXPECTED PERFORMANCE/TEST RESULTS

Solid residuals are sampled annually according to the protocols described in the Section C. Upon receipt of the analytical results, the data will be submitted to NMED to demonstrate the effectiveness of the treatment and that no hazardous constituents remain. A letter submittal that identifies sampling location and analytical results will also be submitted. If contamination exists, the removal, as outlined in Section D-8d(3) will also be communicated.
Gaseous reaction products are not monitored during combustion. The expected gas phase products and downwind concentrations are addressed in Section E-3.

D-8d(3) RESIDUALS MANAGEMENT

Although solid residuals rarely remain after detonation, solid residuals that result from thermal treatment remain in the trench unless the sampling results indicate the need for removal. The following contamination criteria were selected as indicative that residuals from any given treatment event must be removed from the unit:

(1)	TCLP (metals)	>TCLP levels
(2)	organic nitrogen/$N0_3$ (indicates nitroglycerin/nitrocellulose)	>1000 ppm
(3)	TNT/RDX	>1000 ppm
(4)	Antimony (1000 times regulatory standard)	10 ppm

If these values are exceeded, the residuals are removed from the subunit. In addition to removal of the residuals, the first 6 inches of soil in the trench bottom will also be containerized, labeled, and transported to the DRMO facility as hazardous waste.

After removal of the first 6 inches, the soils underlying to a depth of 1 foot will be sampled and analyzed to determined if these criteria are met. Successive removal and sampling at 1-foot increments will be performed until the above criteria are achieved.

EXHIBIT D-1
TECHNICAL ORDER 11A-1-42

EXHIBIT D-2
EXAMPLE OF EOD INVENTORY REPORT

SECTION E

ENVIRONMENTAL PERFORMANCE STANDARDS

E-1 SUBSURFACE ASSESSMENT

E-1a VOLUME AND CHARACTERISTICS OF THE WASTE

The types of wastes that have previously been treated in the 20,000lb ED Area were identified in Section C-1. These wastes may be summarized as:

- Pyrotechnics that contain an oxidant, fuel, priming charge, binder, and in some items colorant, retardant, or other additives.
- Propellant that consists primarily of nitrocellulose and nitroglycerin.
- Explosive devices that contain RDX, TNT, and trace quantities of detracting agents.

The total mass unit per treatment event is 20,000lb pounds of these waste devices. Each category of device will contain different quantities of energetic material. Therefore, the percentage of energetic material contained in the total mass unit varies. Pyrotechnic and propellant devices typically contain a larger percentage of energetic material per total mass than do explosive items. The percentage of energetic material in pyrotechnic devices is estimated to range from 40 to 80% of the total mass. It is estimated that propellant devices typically contain 50 to 60 % of the total mass as energetic material. On a mass basis, explosive devices contain smaller quantities of energetic material (40 to 50% of the total mass of the device). Thus, for any given treatment event the total quantity of energetic material may range from 8,000 to almost 10,000 pounds. The nature of the generating process (shelf-life exceedance, failure to detonate during use, etc.) prohibits strict specification of the total mass of the energetic material present in the 20,000lb ED Area for any discrete treatment event, although it is probable that the total energetic mass seldom exceeds 10,000 pounds. Thus, it is estimated that the average mass of energetic material treated in the 20,000 ED Area is approximately 50,000 pounds per year.

Although some potential exists for dinitrotoluene or hexachlorobenzene to enter the 20,000lb ED Area for treatment, these constituents do not meet the listing criteria for discarded commercial products or products in which the listed constituent is the sole active ingredient. Tetracene (a nitrosaminebased compound) and antimony sulfide meet only the NOS criteria for hazardous constituents and are not specifically listed. Under the conditions of the thermal treatment, the organic constituents are oxidized to CO, CO_2, N_2, NO_x, H_20, and possibly HX of hexachlorobenzene is present and are not expected to remain in the residuals. The posttreatment sampling protocols are designed to

confirm the destruction of these constituents and ensure that these compounds are not present at the time of subunit closure. The potential for hexachlorobenzene as a constituent in the feed stream is very limited because this constituent has been largely replaced by PVC as both additive and colorant.

Thus, both the general nature of the treatment operation and sampling protocols ensure that hazardous waste or constituents are not present at levels of concern. Analysis performed in 1983, shown in Table D-1, indicate that neither the soil, ash, or ordnance casing exhibit EP toxicity. Additional analysis performed during 1984 included the soil and residues from both the side and bottom of an active subunit. These results also indicate that residuals are not EP toxic and that contaminants have not migrated to underlying soils.

Thus, results submitted in a previous section indicate that historically the solid residuals that remain in the 20,000lb ED Area are nonhazardous in nature. The organic constituents of the initial charge are converted to gases during treatment. This distribution of gas products from treatment is indicated in Section E-3. During treatment, the oxidant portion of these energetic items (which is the primary potential source of EP toxic metals) is reduced to the elemental form or the oxide as indicated in Section C. For example, chromium (III) oxide, potentially present in thermite, is converted as elemental chromium during the reaction. Both the feed material and product are insoluble. Barium oxide, possibly present from the nitrate in the pyrotechnic devices, is soluble to the extent of approximately 3.5%. Lead oxide (possibly from pyrotechnics or detonators) is soluble to the limited extend of approximately 20 mg/L. Mercury oxides exhibit solubility similar to the oxides of lead. In general, detonators that are the primary potential source for lead or mercury are excluded in order to reduce the potential for detonation during treatment. Antimony oxide that may form from primer charges is only very slightly soluble (<15 mg/L). Solubility data for both the input constituents and certain other reaction by-products is provided in Tables C-5 and C-7.

E-1b HYDROGEOLOGIC CHARACTERIZATION

Holloman AFB is located in the southern part of the Tularosa Basin. The basin is approximately 120 miles long, bounded 8 miles to the east by the Sacramento Mountains and 20 miles to the west by the San Andreas Mountains. Elevations within the Tularosa Basin range from 4400 feet above mean seal level (MSL) at the northeast corner to 4000 feet MSL in the southwest corner. Elevations at the base range from 4100 to 4028 feet MSL.

Geologically, the Tularosa Basin is a graben structure, bounded on the east and west by mountains which are actually tilted fault blocks (CH_2M Hill, 1988). The base is underlaid by unconsolidated bolson deposits (sediments

carried by water into the closed basin) more than 4000 feet thick in the vicinity of Holloman AFB. Figure E-1 illustrates a general east-west geologic cross section in the vicinity of Holloman AFB. Only the uppermost bolson deposits are of significance to this permit application.

Figure E-3 illustrates the relationship between the Sacramento Mountains and the bolson fill in relation to groundwater occurrence. At the base of the mountains, the hydraulic gradient is quite steep but then flattens out quickly. In the vicinity of Holloman AFB, the ground surface slopes gently to the southwest, but at a slightly higher rate than the water table. Depth to water table at the well fields near the mountains is 270 feet or more below land surface (BLS), while at Holloman AFB the water table is 5 to 10 feet BLS. Figure E-3 and E-4 illustrate the configuration of the water table. Like surface drainage, groundwater flows to the southwest, discharging by evapotranspiration.

The bolson fill is derived from soluble rocks such as limestone, dolomite, and particularly gypsum, of the surrounding mountains. Fresh water recharges the fill at the base of the mountains. Since the bolson fill consists of highly soluble materials, groundwater dissolves formation minerals and water quality degrades with increased contact time. In fact, the only fresh groundwater in the vicinity is near the source recharge.

Results of boring and slug and pump test, conducted from July through November 1987 (Radian corporation, 1988) at Holloman's sewage treatment lagoons, describe the shallow aquifer as being composed of saturated sands, silts, and clays hydraulically interconnected. Discontinuous clays separate coarsegrained, shallow water-bearing sand and silt units from deeper units of equal or greater grain size. The bolson fill aquifer exists under water table conditions in the first saturated shallow zone. With increasing depth, successive clay and silt units created semiconfining conditions. Artesian conditions do not exist at the shallow depths that were investigated. A comparison of transmissivity, hydraulic conductivity , and storage coefficient calculations in the slug tests and pump test yielded values that would be expected in highly stratified inhomogeneous basin fill sediments (see Section E-1d).

E-1b(1) DEPTH TO UPPERMOST AQUIFER

Depth to the water table at well fields near the Sacramento Mountains is 270 feet or more BLS. At Holloman AFB, the water table is 5 to 10 feet BLS.

E-1b(2) ESTIMATED ANNUAL RECHARGE

The annual precipitation at Holloman AFB averages 7.9 inches, with annual extremes from 2.5 inches to 13.5 inches. The mean annual lake evaporation rate, commonly used to estimate the mean annual

evapotranspiration rate, averages an estimate 67 inches per year. The annual net precipitation for the area is approximately -59 inches per year.

E-1b(3) SUBSURFACE CHARACTERIZATION

Most of the base is covered with well-drained soils (fine sandy loam) formed in typsiferous sediments of eolian (wind blown) or alluvial orgin (CH $_2$M Hill, 1983). These soils comprise the Holloman-Gypsum land Yesum complex. The soils are thin and overlie discontinuous beds of gypsum. Below is a typical soil profile as described by the U.S. Department of Agriculture Soil Conservation Service:

A. Horizon - to 3 inches: very pale brown very fine sandy loam, pale brown moist: Weak medium and coarse granular structure: soft, very friable, nonsticky and nonplastic, very few very fine and fine roots: common very fine and fine interstitial pores; strongly calcareous: moderately alkaline: clear smooth boundary.

C1 Horizon - 3 to 13 inches: very pale brown very fine sandy loam, brown moist: massive; soft, very friable, slightly sticky and nonplastic very few fine and medium roots; common fine and very fine interstitial pores: strongly calcareous; moderately alkaline; clear smooth boundary.

C2 Horizon -12 to 20 inches: very pale brown gypsum, pale brown moist; massive; soft, very friable, slightly sticky and nonplastic; very few fine and medium roots; few fine and common very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C3 Horizon - 20 to 60 inches: white gypsum, pale brown moist: massive: slightly hard. very friable, slightly sticky and slightly plastic: common fine and very fine interstitial pores; strongly calcareous; moderately alkaline.

Figure E-2 shows a geologic cross section of the bolson fill deposits in the vicinity of Holloman AFB. The shallow bolson deposits are Miocene to Pleistocene alluvial, clays, sands, and gravels. The sediments are highly stratified. The basal contact of the bolson is estimated to be the top of permian bedrock (depth unknown).

Lithologies encountered during subsurface investigations at Holloman's wastewater treatment lagoons consists of a thin layer (approximately 3 to 11 feet thick) of dry silt and/or sand underlaid by saturated sand or sand and silt layer. The shallow and layer is usually underlaid by a thin clay layer (approximately 2 to 7 feet thick) or interbedded sand, silt, and clay. A second saturated zone consisting of sand, silt, and clay underlies this clay layer. This saturated zone ranges in thickness from approximately 34 to about 50 feet. At these depths, some holes were completed in a green clay layer and some hoses

were completed while still in the saturated zone.

E-1c EXISTING GROUNDWATER QUALITY

Groundwater throughout the Holloman AFB area is naturally high in total dissolved solids (TDS). Field samples taken during an investigation of Holloman's sewage treatment lagoons (Radian Corporation, 1988) revealed TDS levels that exceeded 10,000 mg/L, making the water saline (10,000 to 100,000 mg/L). These TDS levels are attributable primarily to sulfates and chlorides. There has been no sampling for waste constituents specific to the ED unit.

E-1d GROUNDWATER DIRECTION AND FLOW RATE

Water enters the bolson fill aquifer at the edge of the Tularosa Basin and moves downgradient to the southwest. Groundwater discharges by evapotranspiration in the basin's interior near the White Sands National Monument.

Flow rates in the shallow bolson fill aquifer are general low due to the low hydraulic gradient and moderately low permeability of sediments. Calculated groundwater velocities using information derived from slug tests performed in nine piezometers at Holloman's wastewater treatment lagoons (Radian Corporation, 1988) ranged from 0.003 to 0.13 feet per day. Table E-1 shows groundwater velocities based upon the results of the slug tests. The average hydraulic conductivity of 9 piezometers tested was 46 gallons per day per square foot. The average transmissivity value was 210 gallons per day per square foot. Transmissivity, storage coefficient, and hydraulic conductivity data from pump tests (Radian Corporation, 1988) are shown in Table E-2.

E-1e PROXIMITY TO GROUNDWATER WITHDRAWAL POINTS

No water supply wells are located on Holloman AFB because of the poor quality of groundwater (Radian Corporation, 1988). Base potable water supplies are obtained from Bonita Lake and from 21 wells in three separate well fields located on the western slope of the Sacramento Mountains approximately 10 miles east of Holloman AFB. Production wells in that area intercept groundwater at depths ranging from 250 to 300 feet BLS (CH_2M Hill, 1983).

E-1f POTENTIAL IMPACTS ON HUMAN HEALTH

This information is not required for this permit application because the uppermost aquifer (or hydraulically connected aquifers) is not used for drinking water supply. Because groundwater below Holloman AFB contains high TDS (in excess of 10,000 mg/L), the groundwater is designated as unfit for human consumption based upon New Mexico Water quality Control Regulations (Radian Corporation, l988.

Table E-1. Horizontal Groundwater Velocity Results from Nine Slug Tests, Holloman AFB, New Mexico

Well Number	Total Depth (ft. below surface	Hydraulic Conductivity (gpd/ft^2)	Porosity [b] (%)	Velocity [c] (ft/day	(ft/year)
S-2	24.75	7.1	40	0.007	2.6
S-4	20.00	85.6	30	0.13	47.5
S-5	17.00	61.8	40	0.07	25.6
S-8	22.00	56.2	50	0.05	18.3
S-11	19.00	80.2	30	0.12	43.8
S-15	15.00	69.9	30	0.11	40.2
S-16	34.00	45.8	40	0.05	18.3
D-2	77.00	2.8	40	0.003	1.1
D-5	64.70	3.1	30	0.004	1.5
Average		45.8	36.7	0.06	21.0

a Modified from Radian Corporation, 1988.

b Based on the following values for porosity: sand= 30%; silt =40%; clay = 50%.

c Velocity (v) $= \frac{K(dh/dl)}{7.5a}$

Table E-2. Transmissivity, Storage Coefficient, and Hydraulic Conductivity Data and Pump Tests[a]

Well ID	Total ft below surface	Transmissivity (gpd[b]/ft)^2	Storage Coefficient	Hydraulic Conductivity (gpd/ft^2)
P-1	77.00	126	NR[c]	12.6
D-3	75.00	377	0.00005	37.7
S-12	12.00	ND[d]	ND	ND
P-2	12.00	106	NR	10.6
S-13	20.00	ND	ND	ND
S-14	35.00	ND	ND	ND
D-4	58.00	330	0.0002	33

a. Modified from Radian Corporation, 1988.
b. gpd = gallons per day
c. NR =- Not Reported. Jacob straight-line method and Theis curve-matching technique unacceptable due to pump-well interference.
d. ND = Not determined. Drawdown. Drawdown response was sufficient or too sporadic to plot T and S values.

E-lg POTENTIAL IMPACTS ON SUBSURFACE PHYSICAL STRUCTURES AND FOOD CHAIN CROPS

This information is not required because there are no downgradient or near base irrigation wells (Radian Corporation, 1988). Also, corrosive wastes are not generated at the OB unit and there are no physical structures present that may be affected by potential corrosive wastes migrating with groundwater.

E-1h POTENTIAL IMPACTS ON WILDLIFE, DOMESTIC ANIMALS, AND VEGETATION

Because of the high negative rate of not yearly precipitation (approximately -59 inches) and the unsuitability of the shallow aquifer as a drinking of irrigation water source, this information is not required for this permit application.

E-1i LAND USE PATTERNS

Real property records indicate land used for the ED unit consists of leased acreage within the boundary of Holloman AFB. Recommended land use restrictions fro the site (CH^2M Hill, 1983) include restrictions on the following:

- recreational use,
- well construction on or near the site,
- housing on or near the site,
- agricultural use,
- surface water impoundments,
- construction,
- excavation,
- unnecessary burning operations or ignition sources,
- vehicular traffic, and
- site access.

E-1j ASSESSMENT OF GROUNDWATER MIGRATION POTENTIAL

The potential for groundwater contamination at Holloman AFB is high, in general, due to the high groundwater table (10 to 15 feet BLS). This potential is reduced somewhat by the low driving force for vertical contaminant migration (CH^2M Hill, 1983). Contaminants entering the groundwater would move very slowly (due to the low hydraulic gradient and moderately low permeability) to the southwest, towards the White Sands National Monument.

Groundwater at Holloman AFB exceeds 10,000 mg/L TDS making it unusable as a domestic or agricultural water supply source. The nearest downgradient potable supply well is approximately 20 miles west of the base (Radian Corporation, 1988). The nearest livestock well is 3.5 miles to the

southwest.

E-2 SURFACE MEDIA ASSESSMENT

This section reviews the 11 factors that must be considered in the assessment of impacts upon surface media. Surface media refers to surface waters and the soil surface. Data that have previously been provided are only referenced.

E-2a VOLUME AND CHARACTERISTICS OF THE WASTE

The hazardous characteristics, chemical functionalities, physical characteristics, and annual quantities of waste to be treated at these units were previously described in Sections E-1a and C-1. Solubility data presented in Sections C, D, and E-1a are also relevant to the surface media assessment.

E-2b CONTAINMENT FACILITIES

Sections D-2 and D-4 describe preventative measures for migration of waste or waste constituents from the unit. These elements include the pit sidewalls and the earth berm around the clear zone. These elements restrict ejection of waste residuals during treatment events, ensure residuals are retained in the treatment zone, and restrict runon into or runoff from the unit. Additionally, as described in Section D, the area surrounding the detonation zone is graded to divert runon from entering the unit. Thus, the containment design restricts migration to the mechanisms of detonation-related ejection of waste from the unit, and limited quantities of contaminated runon/runoff that escape. Treatment of waste is not performed during precipitation events, if such events are predicted to occur within the 48 hour time frame surrounding the treatment, or if such an event appears imminent.

E-2c HYDROLOGICAL CHARACTERISTICS

Data on surface soils and topsoils surrounding these units were discussed in Section E-1. Most of the base is covered with well drained soils (fine sandy loam) formed in gypsiferous sediments of eolian (wind blown) or alluvial (stream deposition) origin. The soils are thin and overlie discontinuous beds of gypsum. The soils are nearly level with slopes ranging from 0 to 5%. A typical soil profile, as described by the US Department of Agriculture, Soil Conservation Service, follows:

A Horizon - 0 to 3 inches: very pale brown very fine sandy loam, pale brown moist; weak medium and coarse granular structure; soft, very friable, non-sticky and nonplastic; very few very fine and fine roots; common very fine and fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C1 Horizon - 3 to 13 inches: very pale brown very fine sandy loam, brown moist; massive; soft, very friable, slightly stick and nonplastic very few fine and medium roots; common fine and very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C2 Horizon - 12 to 20 inches: very pale brown gypsum, pale brown moist; massive; soft, very friable, slightly sticky and nonplastic; very few fine and medium roots; few fine and common very fine interstitial pores; strongly calcareous; moderately alkaline; clear smooth boundary.

C3 Horizon - 20 to 60 inches: white gypsum, pale brown moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine interstitial pores; strongly calcareous; moderately alkaline.

Surface water resources within the Tularosa Basin are limited by the high evaportranspiration rate and low annual rainfall. Surface water is either lost to evaporation and infiltration or collects in the lowest point in the basin at or near Lake Lucero, located at the southwest edge of the gypsum dune field west of the base. Surface water within the basin makes its way to Lake Lucero. Here, also a discharge point for groundwater, sulfate salts are concentrated by evaporation. The prevailing southwest winds than pick up and transport the salts, primarily gypsum, in a northeasterly direction to continue building the dune field of the White Sands National Monument.

The base is crossed by several southwest trending "arroyos" or intermittent stream beds including Lost River (the largest), Dillard Draw, and several smaller tributaries such as Red Arroyo and Arroyo Cavacita. Lost River is fed by groundwater seeps or springs. The river appears and disappears along its course as springs add water and evapotranspiration and infiltration recapture it.

The intermittent streams and arroyos occurring within the basin are important drainage features only during the infrequent heavy rainfall, conveying surface water southwest to the basin's lowest elevation point.

Surface drainage within the undeveloped parts of the base is controlled by the major arroyos including Lost River, Dillard Draw, and their tributaries. Surface flows are directed southwest toward the White Sands National Monument. Lost River at one time discharged into White Sands National Monument after traversing the base. Lost River has now been dammed on the base just east of the property boundary. This was done to ensure that base storm drainage would not enter the National Monument.

Drainage within the developed portion of the base flows by way of ditches and culverts to the southwest corner of the base in the vicinity of the

wastewater treatment lagoons. Figure E-5 illustrates base topography and drainage patterns.

E-2d PRECIPITATION PATTERNS

A tabular monthly summary for precipitation received at Holloman AFB over the preceding 44 years is provided as Table E-3.

E-2e GROUNDWATER DATA

Depth to the uppermost aquifer is discussed in Section E-1. These data are derived from soil corings taken in the vicinity of the Holloman AFB sewage treatment lagoons. A general hydrogeologic description of the soil stratigraphy for the unsaturated zone, saturated zone, and confining layer is also provided. Groundwater quality data is presented in Section E-1.

E-2f PROXIMITY TO SURFACE WATERS

No continual surface water flow is present in the vicinity of these units. The intermittent flows that occur in Dillard Draw or the Lost River are separated from these units by a considerable distance. All of the thermal treatment units at Holloman AFB are located above the 100-year floodplain elevation.

E-2g WATER QUALITY STANDARDS AND USE

No water quality standards apply to the intermittent surface flows present at Holloman AFB. The only continual bodies of water present on the base are the sewage treatment lagoons located in the southwest portion of the base.

E-2h WATER QUALITY DATA

Water quality data are not applicable to the intermittent stream flows that result from precipitation events.

E-2i LAND USE PATTERNS

Local land use designations for the areas surrounding these units are discussed in section E-1i. A land ownership map for the immediate vicinity is provided as Figure B-5 (in back pocket). No industrial development zones are located near Holloman AFB. Any contaminant migration to surface waters would, therefore, not impact industrial development.

E-2j IMPACTS ON HUMAN HEALTH

Impacts to human health that may be caused by migration of waste or

waste constituents are expected to be limited in scope. The intermittent waters of Holloman AFB are not withdrawn for drinking water or industrial use. Volatilization of any organic contaminant is not expected as these contaminants will be converted largely to gas form during treatment.

The more possible impact to human health would occur from contaminated runoff entering one of the intermittent streams. However, the potential for this form of migration is exceptionally limited by the low rainfall and high evaporation rates of the area. Additionally, with the exception of ejected fragments, the residuals from treatment events are contained below surface level. The units used for treatment are treated in areas of limited relief.

E-2k POTENTIAL IMPACTS ON WILDLIFE, DOMESTIC ANIMALS, AND VEGETATION

No livestock operations are conducted within the ED area or surrounding area. Livestock grazing may occur sporadically approximately 0.5 miles east of the 20,000 ED Area, but no impacts that result from surface-water-carried migration can be envisioned that would affect this operation because it is not traversed by waters local to the unit. No horticultural or silvicultural operations are located in the vicinity of the reservation.

If migration of waste or hazardous constituents occurred by surface water transport, some exceedingly limited impact upon these species may occur through use of nearby waters as a drinking source or from surface contact.

The only threatened or endangered species that occurs on Holloman AFB is the White Sands Pupfish that resides in the brackish pools of the lower Lost River. The species is a group of two species as classified by the State of New Mexico, but is not listed by the U.S. Fish and Wildlife Service. Because of the distance of these waters from the units, no impacts can be envisioned.

E-21 ASSESSMENT OF SURFACE WATER MIGRATION POTENTIAL

Assessment of the factors presented in this section indicates that the potential for migration of waste or hazardous constituents by surface water transport is limited . Contaminant transport to surface soils or surface waters adjacent to the 20,000lb ED Area is limited to deposition of particulates ejected during detonation. The limited quantity and wide-area dispersion of the deposited contaminants would limit any impact to minimal effects. Although some “hot spots” may result through this deposition, the potential for their formation is limited and the size of such localized contamination would be very small. Additionally, posttreatment inspections to collect fragments will reduce the potential for this type of transport. Furthermore, because of the arid climate, runoff contamination from any such localized zones would be of

limited duration. Only hazardous metal constituents would be expected to exhibit appreciable environmental half-lives and the soil samples are screened for those constituents. Additionally, the general operational characteristics in which the unit is regularly covered further reduces runoff based transport.

E-3 AIR ASSESSMENT

E-3a VOLUME AND CHARACTERISTICS OF THE WASTE

Refer to Section E-1a for a discussion of waste volume and characteristics.

E-3b REDUCTION OR PREVENTION OF EMISSIONS

There are no structures or control systems designed to prevent or reduce emissions of hazardous constituents to the air.

E-3c OPERATING CHARACTERISTICS

The ED unit at Holloman AFB is currently operated on an intermittent basis for treatment of waste energetic items. Nearly all of the energetic materials are transformed into gaseous or particulate form. Operating procedures for both subunits were presented in Section D. The time required for the detonation process consists of two components which include the following:

- waste placement and stacking (1 to 8 hours),
- detonation inspection (1 hour)

The emissions associated with the process are nearly instantaneous due to the nature of the treatment process. Total emissions and analysis of potential receptor exposures are presented for typical treatment cases in Section E-3f.

E-3d ATMOSPHERIC, METEOROLOGICAL, AND TOPOGRAPHIC CHARACTERISTICS

The 20,00lb ED Area at Holloman AFB is situated on flat terrain. There are no complex topographic features in the vicinity. The meteorologic conditions on-site were previously presented in Table E-3. Additionally, wind roses for the last four quarters are summarized in Figure E-6. (Vol 2, page 10)

E-3e EXISTING AIR QUALITY

Otero County, NM, is identifies as an attainment area for all National Ambient Air Quality Standards (NAAQS). Holloman AFB emits none of the

NESHAP parameters other than benzene, toluene, and xylene from fueling of aircraft. Table E-4 summarizes state and federal NAAQS and PSD increments.

E-3f ASSESSMENT OF AIR MIGRATION POTENTIAL

In order to assess the potential for contaminant migration via the air medium, the types and quantities of emissions must be identified for treatment methods as applied to the routine waste streams. A search of available literature reveals that there is some data in regard to detonation products of explosive materials but a scarcity of information on detonation explosives. the following discussion on detonation emissions is excerpted from AP-42, EPA.

"The emissions from explosives detonation are influenced by many factors such as explosive composition, product expansion, method of priming , length of charge, and confinement. These factors are difficult to measure and control in the field and are almost impossible to duplicate in a laboratory test facility. With the exception of a few studies in underground mines, most studies have been performed in laboratory test chambers that differ substantially from the actual environment. These approximations cannot be made more precise because explosives are not used in a precise, reproducible manner.

Carbon monoxide is the pollutant produced in greatest quantity from explosives detonation. TNT, an oxygen deficient explosive, produces more CO than most dynamites, which are oxygen balanced. But all explosives produce measurable amounts of CO, Particulates are produced as well, but such large quantities of particulate are generated in the shattering of the rock and earth by the explosive that the quantity of particulates from the explosive charge cannot be distinguished. Nitrogen oxides (both NO and NO_2) are formed, but only limited data are available on these emissions. Oxygen deficient explosives are said to produce little or no nitrogen oxides, but there is only a small body of data to confirm this. Unburned hydrocarbons also result from explosions, but in most instances, methane is the only species that has been reported."

A literature search was performed to identify the relative concentrations of CO, NO_x, CO_2, HX, and P_4O_{10} that result from the thermal treatment of propellants, explosives, and pyrotechnics that contain $TlCl_4$ and phosphorus. Some limited data on the detonation of propellants and explosives was found. Emissions data from detonation of nitrocellulose/nitroglycerin (NC/NG) propellant mixtures, TNT, and RDX were found in the literature. Limited data from burning of NC/NG propellant and TNT were also found.

The limited data available were used to formulate mean balance emissions for anticipated worst-case scenarios. The assumptions utilized in these calculations were:

(1) Alkyl nitrate energetics behave in a manner similar to NC/NG.

(2) Aryl nitrate energetics behave similarly to TNT and/or RDX.

(3) Propellant mixtures contain approximately 50% energetic material as a percentage of the total mass.

(4) Pyrotechnics contain approximately 75% of the total mass as the energetic material.

Based on these assumptions and extrapolation of the literature data, worst-case scenarios were developed in order to project emissions. A summation of the cases is presented below.

Case 1: Assumes detonation of 20,000 pounds of rocket motors containing 10,000 pounds of NC/NG propellant. A carbon monoxide yield of 1000 pounds was calculated: NO_x emissions were negligible.

Case 2: Assumes open burning of 250 pounds of 33% propellant and 66% mixed aryl nitrate explosives. This scenario yields the largest CO and NX_x values. The CO yield was calculated as 8.3216 and NO_x was estimated at 9.15 pounds. The mixture was assumed to be 25% energetic material.

Case 3: Assumes OB of 250 pounds of phosphorus based charges and incindiary devices considered to be 75% energetic material (including $T1C1_4$). The yields for this scenario were P_40_{10} (388 pounds) HC1 (46.9 pounds), and TSP (41.3 pounds).

Case 4 Assumes OB of 250 pounds containing hexachlorobenzene pt-12% to be 75% energetic material. The thermal NO_x yield was 5.6 pounds and the HC1 yield was 20.6 pounds.

Case 5: Assumes OB of 250 Pounds of NC/NG considered to be 100% energetic. The NO_x yield was 50 pounds and the CO yield was 87.5 pounds.

The mass balance basis used for calculations is presented as a fraction of pounds of charge in Tables E-5. Values for burning of pyrotechnics are based strictly on mass balance of theoretical combustions.

The worst-case values were used as input values for the PUFF model 13 and the outputs are provided as Exhibit E-2.

The output from the model indicated that detonation of these large masses will exceed the NAAQS at distances of 0.5 km, but that the concentration was approximately 50% of the NAAQS value (40 mg/m^3) at a distance of 1.0 km. This was the only scenario that violated any criteria pollutant NAAQS.

TABLE E-5. PROJECTED EMISSIONS FROM EXPLOSIVES DETONATION

	ESTIMATED EMISSIONS RATE (POUNDS PER POUND CHARGE)				
Charge	N_2	NO_x	CO	CO_2	H_2O
RDX,HMX	0.38	NEG[a]	0.25	0.20	0.01
Propellant Mix	0.19	NEG	0.10	0.56	0.12
TNT, Cyclotol	0.10	Neg	0.60	0.50	0.25

[a] Neg - negligible

EXHIBIT E-1

DESCRIPTION OF PUFF MODEL AND OUTPUT

FOR WORST-CASE EMISSIONS

E. Description of Puff Release

The dispersion of a puff can be described in Gaussian terms just as the continuous release. In a continuous model the plume disperses in the vertical (z) and horizontal cross wind (y) direction. In a puff model the dispersion takes place in the z, y, and downwind (x) direction. The calculated concentration is the peak instantaneous concentration and it is independent of wind speed.

When a release occurs the gas forms a spherically-shaped cloud just above the point of release. The concentration in the cloud is highest at the center. The cloud then is transported by the wind growing in size as it entrains ambient air. The growth of the cloud and its movement can be compared to a balloon that gradually inflates as it is moved by the wind. The mass of the gas in the cloud does not change as the cloud moves downwind, but its concentration does, as more ambient air is entrained.

Sometimes the release is not instantaneous but takes place over a period of several minutes such as when gas in a cylinder leaks out or during the interval between the time a leak in a valve is discovered and it can be stopped. In cases such as these the cloud may become somewhat elongated and look like a blimp or a hot dog. By assuming an instantaneous release a puff model will overestimate peak concentrations, but it will have virtually no effect on average concentrations provided the average concentrations provided the averaging time is long enough.

F. Puff Model dispersion Coefficients

The EPA puff model uses dispersion coefficients developed by studying instantaneous release.[6] These coefficients generally provide for less plume dilution than the familiar Pasquill-Gifford coefficients. The table show the dispersion coefficients. Figures 10 and 11 plot the coefficients on a diagram of the Pasquill-Gifford coefficients.

Coefficient = ax^b where x is downwind distance in meters

	Horizontal (x and Y)		Vertical (z)	
Stability	a	b	a	b
Unstable	.14	.92	.53	.73
Neutral	.06	.92	.15	.70
Very Stable	.02	.89	.05	.61

Since the dispersion in the x and y direction are generally considered to be equal, some authors refer to the standard deviation in the horizontal as σ_r (r

for radius).

G. Average Concentrations from Puff Release

Average Concentration is a function of wind speed. For example, a wind of 10 knots will transport twice as much air past a site as wind of 5 knots. The average concentration is a function of the number of standard deviations in the horizontal direction (sigma -x or sigma-r) that pass a given point for the averaging time in questions. At long downwind distances and low wind speeds the average concentration will not be much less than the peak instantaneous concentration. The puff has become so dilute that possibly less than one sigma passes a point for the averaging time specified.

At the other extreme, there is a significant difference between average and peak instantaneous close to the release point. This is because the puff is small in dimension and most of the material passing a point is air except for the very concentrated puff. Figure 12 illustrates how a puff would disperse from a pipeline break.

H. Puff Equations

The basic equation is :

$$x_f = \frac{Q_m}{(2\pi)^{1.5}\sigma_x\sigma_y\sigma_z} \exp\{-\frac{1}{2}\{\frac{y}{\sigma_y}\}^2\} \{\exp\{-\frac{1}{2}\frac{(H+z)}{\sigma_z}\} + \exp\{-\frac{1}{2}\frac{(H-z)^2}{\sigma_z}\}\}$$

Note that Q is a release quantity in this equation, not a release rate. X is a peak instantaneous concentration, not the average concentration.

x_f = peak instantaneous concentration (grams per cubic meter)
Q_m = Source strength (grams)
π = 3.1416
σ_x= horizontal downwind dispersion coefficient (meters) (This value is often set equal to σ_y)
σ_y = horizontal crosswind dispersion coefficient (meters)
σ_z = vertical dispersion coefficient (meters)
H = effective stack height (meters)

I. When to use Puff or Continuous Release Models

The puff model should be used when the release interval of the cloud is less than the travel time of the cloud. For example, if the release took place over a period of 10 minutes, then it would be appropriate to calculate concentrations at receptors beyond a 10-minute travel time distance it would be appropriate to use a puff 14 model based on the release of a series of puffs at intervals of, say, one minute or use a continuous release model such as PAL or ISCST.

14. For receptors within a 10 minute travel time distance it would be appropriate to use a puff model.

SECTION F

PROCEDURES TO PREVENT HAZARDS

This section addresses security procedures, inspection requirements, preparedness requirements, procedures taken to prevent accidental detonation, prevention of mixing of incompatible waste, and means to reduce personnel exposure. The procedures outlined in this section are designed to ensure compliance with 40 CFR 264.601 and the general requirements of 40 CFR 264.33 and 40 CFR 264.15.

F-l SECURITY

This section summarizes security precautions relative to Holloman AFB and 20,000 ED treatment units within the base confines. Holloman AFB is located on approximately 50,700 acres that consist primarily of unimproved property. White Sands Missile Range and White Sands National Monument bound the base to the north and south, respectively.

F-la SECURITY PROCEDURES AND EQUIPMENT

F-la(1) 24-HOUR SURVEILLANCE SYSTEM

The primary mission of Holloman AFB is to provide upgrade and continuation training for aircrews assigned to T38, F-4, and F117 aircraft. Additionally, solid base propulsion systems for military devices are tested at the area identified as the Test Track. The general nature of these activities is such that portions of the base facility are under constant surveillance. In particular, such areas include the Test Track Facility, flight line areas, and the munitions building. In addition to these surveillance measures, the main base area and any base area adjacent to these secure zones is patrolled at intervals both day and night. Traffic access to Holloman AFB is provided only by Highway 70 that traverses the southern boundary of the base and La Luz gate on the eastern boundary. Access can also be gained from White Sands Missile Range. Entrances to the base from Highway 70 are manned by armed guards 24-hour per day. These general surveillance practices provide general 24-hour surveillance to the treatment unit.

F-la(2) BARRIER AND MEANS TO CONTROL ENTRY

The 20,000LB EOD Area is located at the end of a single access road which runs approximately 20 miles along the length of the test track. Entrance to the test track area is controlled by Test Track personnel and the Security Police. Entrance to these units is restricted to authorized visitors on approval of the EOD supervisor. Visitors to the units must be accompanied by EOD personnel. Additionally, the treatment unit is provided with only a single

entrance.

F-la(3) WARNING SIGNS

Warning signs that indicate the controlled access nature of the treatment unit is present at the entry point to the facility boundary. The unit is posted with signs that state: "Danger, Explosive Disposal Area, Keep Out". The signs at the entrance and along the circumference of the surrounding fence of distances at intervals of 300 feet are legible at distances greater than greater than 25 feet. The sign are in English and Spanish.

F-2 INSPECTION SCHEDULE

F-2a GENERAL INSPECTION REQUIREMENTS

The complexity and special nature of the activities conducted at Holloman AFB result in delegation of responsibility for general inspection requirements among various groups. Corrective action for deficiencies found during these routine inspections, repair and preventive maintenance of various items of equipment, and maintenance of inspection records are also delegated among these various groups. Among the areas covered by the routine inspection and maintenance activities are:

- Fire control Equipment: fire extinguishers, pump truck equipment (pumps, hoses, horns and sirens, etc.) fire alarms, and self-contained breathing apparatus.
- Emergency Equipment: protective clothing, safety glasses, face shields emergency eyewashes, chemical respirators, etc.
- Security Equipment: fences, gates, locks, facility lighting, signs, etc.
- Structures: road surfaces, vegetation-free zones, fireboards
- Communication Systems: radios, base intercom, base evacuation system, etc.
- Vehicular Equipment: transport vehicles.

An inspection program has been established to inspect all components of the treatment units for malefactions, deteriorations, signs of contaminant release that indicate potential for migration of hazardous waste constituents to the environment, or the potential for human endangerment. These inspections are performed prior to treatment, after treatment, and at regular intervals during inactivity to permit the use of corrective measures that will minimize such problems.

Vehicles used to transport demolition materials, explosives, and personnel are inspected daily and inspections documented on AF Form 1800.

Table F-1 presents the inspection schedule for inspecting safety and

emergency equipment, security devices, structural equipment, communications equipment, mobile equipment, and range areas. Also listed is inspection of the clear zones around these units for vegetation. Clearing operations of the natural vegetation are then based on these inspections.

F-2a(1) TYPES OF PROBLEMS

The inspections schedule identifies the types of problems (e.g., malfunctions or deteriorations) which are checked during inspections.

F-2a(2) FREQUENCY OF INSPECTION

Inspection of all materials, security devices, safety equipment, and communication devices will be inspected before each EOD operation. This frequency of inspection will determine equipment deteriorations and malfunctions between inspections.

F-2b SPECIFIC PROCESS INSPECTION REQUIREMENTS -- Not Applicable

F-2b(1) CONTAINER INSPECTION -- Not Applicable

Table F-1 General Inspection Schedule

Area/Equipment	Specific Item	Types of Problems	Frequency of Inspection Monthly
Safety and Emergency Equipment	Face shields and extra protective eyeglasses	Broken and dirty equipment	Monthly, as needed
	Disposable respirators	Out of stock, not required, filter types for materials being handled.	
	Fire extinguishers (Min.= 2)	In need of recharging	Monthly/after each use
	Vehicular radio; handheld radio	Inoperable	As used
	First aid equipment and supplies	Items out of stock or inoperable	As used
	Protective clothing (impermeable full body coveralls, gloves and foot coverings	Holes, thin areas, tears	As used
Security Devices	Facility fence	Corroded chain-fence and barbed wire, burrowing, signs of intrusion	Bi-weekly
	Signs	Illegible	Bi-weekly
EOD Vehicle	Brakes	Worn pads and rotors	Prior to each treatment
	Hydraulics	Leaking	Prior to each treatment
	Trailer hitches	Loose and missing safety chains	Prior to each treatment
	Running emergency lights	Burned out	Prior to each treatment
	Horns/sirens	Inoperative	Prior to each treatment

Table F-1. General Inspection Schedule

Area/Equipment	Specific	Types of problems	Frequency of Inspection
Operating equipment	Demolition tool kit	Items missing and damaged	Prior to use
	General purpose tool kit	Items missing and damaged	Prior to use
	Pioneer tool kit	Items missing and damaged	Prior to use
	Demolition ordinance/initiation agents	Nonserviceable, exceeds shelf life damaged, corroded, deteriorated	Weekly, prior to use
Treatment Zone	Waste items	Inventory reconciliation	Prior to transport or treatment
	Residuals	Scattered, free-standing liquids	After treatment
	Trench walls	Settlement, cave-in	Before use Monthly
	Clear zone/general area	Vegetation, burrowing, corrosion, signs of runon/runoff	
	Firebreak	Vegetation, scrap, debris	Monthly
	Roads	Settlement, holes, ditches	Annual

F-2b(2) TANK INSPECTION -- Not Applicable

F-2b(3) WASTE PILE INSPECTION -- Not Applicable

F-2b(4) SURFACE IMPOUNDMENT INSPECTION -- Not Applicable

F-2b(5) INCINERATOR INSPECTION -- Not Applicable

F-2b(6) LANDFILL INSPECTION -- Not Applicable

F-2b(7) LAND TREATMENT INSPECTION -- Not Applicable

F-2b(8) MISCELLANEOUS UNIT INSPECTION

The inspection schedule used for the treatment unit is provided as Table F-1. This inspection plan addresses unit specific structures, emergency equipment, operational equipment, safety equipment, communications systems, transport vehicles, and the treatment zone (including the cleared area).

F-2c REMEDIAL ACTION

If inspections reveal that nonemergency maintenance is needed, then Holloman AFB personnel will initiate immediate action(s) to preclude further damage and reduce the need for emergency repairs. If a hazard is imminent, or has already occurred during the course of an inspection, or any time between inspections, then remedial action will immediately be taken. Appropriate authorities will be notified according to the Holloman Contingency Plan, Section G of this application. In the event of an emergency involving the release of hazardous constituents to the environment, efforts will be directed towards containing the hazard, removing it, and subsequently decontaminating the affected area as outlined in the Holloman AFB Contingency Plan. The general nature of the remedial action to be taken is noted in the Inspection Log.

F-2d INSPECTION LOG

A sample inspection log for these units is given in TO 11A-142. The log includes spaces for the date of the inspection, identity of the inspector, and the specific items to be inspected and provides for records of remedial action.

F-3 WAIVER OF PREPAREDNESS AND PREVENTION REQUIREMENTS

No waiver is requested.

F-3a EQUIPMENT REQUIREMENTS

F-3a(1) INTERNAL COMMUNICATIONS

Refer to the Holloman Spill Prevention and Response (SPR) Plan for information on the alarm system at Holloman AFB. Personnel that enter the treatment zone for inspection of operation are provided with hand-held two-way radios.

F-3a(2) EXTERNAL COMMUNICATIONS

External communications capabilities are provided through the base operator. Communications systems include Defense Switched Network (DSN), FTS, and Southwest Bell System.

F-3a(3) EMERGENCY EQUIPMENT

Refer to the emergency equipment available at the treatment units during operations which includes fire extinguishers, two-way radios, and personnel protective equipment such as gloves and respirators.

F-3a(4) WATER FOR FIRE CONTROL

Water for fire control is not available at this unit. Base fire department trucks are available during operations for emergency response.

F-3b AISLE SPACE REQUIREMENTS -- Not Applicable

F-4 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT

F-4a UNLOADING OPERATIONS

Procedures to prevent incidental detonation of the waste are also applicable to spill prevention during pretreatment operations. These procedures are indicated in Section C. EOD procedures to prevent accidental detonation are detailed to TP 11A-1-42 and TP 11A-1-60. In general, these procedures specify use of nonsparking tools, encasement to reduce impact, use of certain clothing materials, and, most importantly, removal of primers and initial detonators from the device. The explosive nature of the waste indicates the greater hazard to be incidental detonation during transfer of waste into the detonation zone. None of the energetic waste contains free liquid.

F-4b RUNON AND RUNOFF

Runon is prevented from intering this unit by the berm surrounding the treatment area. Additionally, the area surrounding the units is inspected on a regular basis for signs of visible contamination (detonation fragments or discoloration). Detonation fragments that are discovered are collected and inspected by EOD for signs of reactivity. If any surrounding soils exhibit signs of visible contamination, the soils will be analyzed by the protocols indicted in Section C and, if necessary, collected for disposal as hazardous waste. In addition, a complete hydrogeological survey will be completed in 1993 to assess runon and runoff affects. Results of the survey will be forwarded to NMED.

F-4c WATER SUPPLIES

No water lines are present in the vicinity of these units. Impacts to surrounding groundwater or surface waters are discussed in Section E.

F-4d EQUIPMENT AND POWER FAILURE

Operations at the unit will not be affected if a facility power outage occurs. None of the unit-specific equipment requires electrical power.

F-4e PERSONNEL PROTECTION EQUIPMENT

The equipment appropriate for employees at specific facilities and areas of the plant is specified by EOD orders and the bioenvironmental engineer. They consider the characteristics of the waste types to be handled, including toxicity, ignitability, reactivity, corrosivity, routes of exposure, and similar information. The bioenvironmental staff reports to the OSC whenever the Contingency Plan is implemented, and they assist him in specifying the protective equipment for firefighters, rescue teams, spill cleanup personnel, equipment decontaminators etc.

Procedures to ensure safe handling of these reactive waste are detailed in TOs 11A-1-42 and 11A-1-60. All operations are performed by fully-trained EOD personnel under the direction of the EOD Supervisor. These personnel are familiar with procedures to be followed for the material being handled.

F-5 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES

F-5a PRECAUTIONS TO PREVENT IGNITION OF REACTION OF IGNITABLE OR REACTIVE WASTE

Each waste item that is destined for treatment at the unit is handled in accordance with TOs 11a-1-42 and 11A-1-60. Waste energetic items are not opened at any time due to the potential for incidental detonation. Postdetonation residues are inspected to ensure no untreated waste remains in the zone.

F-5b GENERAL PRECAUTIONS FOR HANDLING IGNITABLE OR REACTIVE WASTE AND MIXING OF INCOMPATIBLE WASTE

The general procedures for handling these wastes are detailed in referenced TO procedures

F-5c MANAGEMENT OF INCOMPATIBLE WASTE IN CONTAINERS-

No waste is stored at these units prior to thermal treatment.

F-5d MANAGEMENT OF INCOMPATIBLE WASTE IN CONTAINERS-Not Applicable

F-5f INCOMPATIBLE WASTE IN TANKS-Not Applicable

F-5g IGNITABLE OR REACTIVE WASTES IN WASTE POLES-Not Applicable

F-5h INCOMPATIBLE WASTES IN WASTE PILES-Not Applicable

F-5i IGNITABLE OR REACTIVE WASTES IN SURFACE IMPOUNDMENTS- Not Applicable

F-5j INCOMPATIBLE WASTE IN LANDFILLS-Not Applicable

F-5k IGNITABLE OR REACTIVE WASTES IN LANDFILLS-Not Applicable

F-5l INCOMPATIBLE WASTE IN LANDFILLS-- No- Not Applicable

F-5m LIQUID WASTES IN LANDFILLS -- Not Applicable

F-5n SPECIAL REQUIREMENTS FOR CONTAINERS DISPOSED IN LANDFILLS --Not Applicable

F-5o IGNITABLE OR REACTIVE WASTES IN LAND TREATMENT --Not Applicable

F-5p INCOMPATIBLE WASTE IN LAND TREATMENT Not Applicable

As indicated in Sections C and D, the general formulation of these items incorporates multiple energetic compounds in a manner known as a

"Detonation Train". Additionally, the compounds are often commingled in binary or ternary explosive formulations. For this reason, some of the energetics that are combined exhibit incompatibility under normal conditions.

SECTION G
CONTINGENCY PLAN

The information provided in this section is adopted from the Holloman AFB Spill Prevention and Response Plan, Holloman AFB Regulation 136-2. The plan is divided into six sections that identify:

- overall mission,
- designated parties and their responsibilities
- spill prevention, control, and countermeasures,
- contingency plan requirements and actions,
- contingency training, and
- plan review and update.

Additionally, the Spill Prevention and Response Plan provides a series of annexes that identify contingency requirements for specific and other nonspecific base locations. Annex II-8 is used in conjuction with the sections of the Spill Prevention and Response Plan indicated above in response to emergencies at these locations. The Spill Prevention and Response Plan is provided as Exhibit G-1

G-1 GENERAL INFORMATION

OB/OD operations occur at three location on Holloman AFB identified as the EOD training range, moving trench, and test tract. Accordingly, contingency information is provided for these three locations.

This contingency plan will continually be reviewed and revised if any of the following occur: the facility permit is revised; the plan is inadequate in an emergency; the procedures herein can be improved; facility operations change in a way that alters the plan the emergency coordinator changes; or the emergency equipment list changes. Amendments to this plan can be initiated by any responsible party. Proposed changes may be submitted to 49 CES/CEV as the office with primary responsibilities to represent the permit holder. Adopted changes will be provided to all record holders of this permit application.

Copies of the plan are available at the Holloman AFB civil engineering office and the base EOD office.

The facility name, address, ID number, and owner/operator are provided below:

- Name: Holloman
- Owner: United States Air Force

- Operator: 49 CES/CEV
- EPA ID No: NM6572124422

16 A copy of the topographic map included in Figure B-4 shows the area surrounding the unit. Figure B-3 designates the location of the unit relative to the main base area.

G-1 EMERGENCY COORDINATORS

The emergency coordinators will coordinate and direct control and cleanup efforts at the scene in case of an incident involving the transportation, handling, or demolition of explosive waste items. The emergency coordinators can designate other personnel to assist them in the event of an emergency and have the full authority to obtain fire and medical support service should the need arise.

Prior to operations by EOD personnel, the EOD supervisor contacts the following base offices: meteorology, munitions, medical services, security police, base operations, Environmental Coordinator, and fire chief and the NMED. Therefore, the capabilities of these organizations are alerted in the event that potential emergencies occur during EOD treatment operations.

The primary on-scene coordinator (ISC) for Holloman AFB is the Commander, 49th Support Group. The title and work phone number of the primary OSC and designated alternates are provided below:

Title	Base Phone No.
Commander	5541
Base Civil Engineer	3071
Base fire Chief	1117
Command Post	7575

G-3 IMPLEMENTATION

The decision to implement the Contingency Plan for the unit depends upon whether an imminent or actual incident could threaten human health or the environment. The purpose of this section is to provide guidance to the emergency director in making this decision by providing decision-making criteria.

The Contingency Plan will be implemented in the following situations:

- An unplanned fire or unplanned explosion occurs at an OB/OD unit such that:

- the potential for human injury exists;
- toxic fumes that could endanger human health or the environment are released;

- the fire could spread on-site or off-site and possibly ignite other flammable materials or cause heat-induced explosions;
- the use of water and/or chemical fire suppressants could result in contaminated runoff that could endanger human health or the environment; and
- an imminent danger exists that an explosion could ignite other hazardous wastes at the facility and possibly result in the release of toxic material.

° A spill or unplanned release of hazardous material occurs the unit such that;
- the spill could cause the release of toxic liquids or fumes that could endanger human health or the environment;
- the spill cannot be contained in the immediate areas resulting in potential off-site soil contamination and/or ground or surface water pollution that could endanger human health or the environment; and
- the spilled material inadvertently detonates or combusts.

° A fire or explosion occurs during transport of the waste or residuals to or from the unit.

° A planned treatment event results in:

- damage to the unit beyond that normal to such treatment event and such that release is imminent; or
- ignites any structure, road surface, etc. in the vicinity.

° During rupture of a cylinder, the cylinder is released from its securing device.

G-4 EMERGENCY RESPONSE PROCEDURES

G-4a NOTIFICATION

The EOD team members discovering a potential emergency incident at any of these units will notify Range Control. The Range Control Supervisor will, in turn, notify the OSC or alternate. The OSC or alternate will immediately activate the internal alarm system to notify or evacuate personnel, if appropriate. In addition, the OSC or alternate will notify the base Fire Chief, Environmental Coordinator, Base Civil engineer, and Medical Services as required.

The appropriate local agencies with designated response roles will be notified by the OSC if their help is needed. The appropriate state agencies will

be notified is their assistance is needed, or the incident requires reporting of this level.

The evacuation routes to be used in the event of an emergency, noted in Section G-3, are the unit entrances, provided that the extent of the incident may be limited to the immediate vicinity but temporary evacuation is required. Evacuation from the main base are, if required, is designated in Holloman AFB Disaster Plan 355-1, Disaster Preparedness. Notification and evacuation are further addressed in the Spill Prevention and Response Plan (Exhibit G-1) and Disaster Plan 355-1 (Exhibit G-2).

G-4b IDENTIFICATION OF HAZARDOUS WASTES

The OSC will immediately identify the character, exact source, amount, and a real extent of the material involved in the unplanned incident. The initial identification method will be by visual inspection of the incidents effects, spilled material, and location of the release. Plan records, including inventories and process and waste log sheets, are available at the EOD and base Environmental Coordinator's office to aid in estimating the composition and quantity of released material. Base Bioenvironmental Engineering will sample to verity hazardous material identification to determine boundaries of contaminated areas and contaminant concentrations, and to verify proper cleanup activities are completed.

Resources such as plant storm-line diagrams and material-storage locations are available at the Base Operations office and will be utilized to determine control procedures.

G-4c HAZARD ASSESSMENT

Possible hazards to the environment and public health will b e assessed by the OSC, and the need for local evacuation and notification of local authorities will be determined. In assessing the situation, the OSC will consult with the Environmental Coordinator, Bioenvironmental Engineer, and base Fire Chief. These parties will consider both direct and indirect effects of the event on human health, welfare, and natural resources. In assessing the event, the potential for direct and indirect effects shall indicate, but not be limited to, fire, explosion, further release occurrence, toxic gases, or injection by runon and runoff. The following portions of the Spill Prevention and Response Plan are referred to for this assessment: Annex I, Annex II-8, Annex III and Annex VI. Action will be taken to control releases and minimize effects during such an emergency, if the situation involves the release or potential release of toxic effluents.

The OSC (in conjunction with the noted personnel) will determine whether unit has had a release which could threaten human health or the environment outside the base. Bioenvironmental Engineering will survey the area and advise the OSC in the establishment of protective boundaries around the contaminated areas.

If a release results in a vapor cloud, several methods are available for assessing the hazards. Portable equipment for direct air monitoring can be used to make a rapid determination of the most volatile organics.

Meteorological data, including wind, speed, wind direction, temperature, dew point, barometric pressure, and an automatically-calculated stability factor are continuously available from base meteorological towers. These data, along with information about the source of an atmospheric release, can be used to predict the direction, extent, and estimated concentration profile of a contaminated release.

If the assessment of the incident indicates that evacuation of areas downwind of the unit may be advisable, the OSC will immediately notify HQ ACC/CEV and the appropriate local authorities. He will consult with these officials to help decide whether local areas should be evacuated. The OSC or the Environmental Coordinator will immediately notify the National Response Center (using their 24-hour toll free number, 800-424-9902).

G-4d CONTROL PROCEDURES

Potential accidents at these units can be considered either unplanned fire/explosion, inadvertent facility damage, or spill material release. Natural disasters such as earthquakes, hurricanes, or tornadoes are not assumed to cause actions which fall into one of these categories. Procedures for responding to these incidents are contained in the Spill Prevention and Response Plan, Disaster Preparedness Plan, and TO 11A-1-60. Specific actions to be taken at these units include:

° Ordnance Transportation Vehicles

- Explosion. In the event of an explosion, personnel will immediately withdraw to a safe distance and evaluate the situation. NOTE: This does not apply to detonation during transport which requires immediate implementation of the referenced Spill Prevention and Response Plan and Disaster Plans. Heavy-bodied trucks have been specifically chosen for this task due to the inherent risk associated with these materials. Transport limits and requirements are specified in relevant EOD technical orders.

- Fire. In the event of a fire involving a transport vehicle with ordnance on-board, an attempt to control the fire with available

extinguishers may be permissible if the fire is initially away from the ordnance. If not, personnel will withdraw to a safe distance and advise appropriate authorities.

° Material Spill. In the event of a diesel fuel spill, shovels will be used to construct a dike around the spill to contain lateral movement. As much free liquid as possible will be returned to the container. The fuel-soaked soil will be excavated and placed in impervious recovery containers for transportation to an approved disposal location. The base Environmental Coordinator will be contacted for disposal information.

G-4e PREVENTION OF RECURRENCE OR SPREAD OF FIRES, EXPLOSIONS, OR RELEASES

The Holloman Spill Prevention and Response Plan should be referenced for this information. At a minimum, follow-up actions will include:

° Start actions to collect, treat, and dispose of nonexplosive waste or other materials as appropriate. This will be a joint operation involving EOD, fire, and Bioenvironmental Engineering personnel.

° Ensure that EOD, fire, and safety personnel investigate the cause of the emergency and provide a technical report to the Commander, 49th Support Group within 72 hours.

° Ensure that proper restoration actions are started as soon as possible after appropriate explosives decontamination procedures have been completed. This will be a joint operation between safety and civil engineering personnel for Air force incidents. All decontamination actions will be documented and the records permanently maintained at Air Force EOD, Safety, and real estate offices.

° Ensure that equipment repaired or replaced as a result of the incident is recertifed, as necessary, prior to being placed.

G-4f STORAGE AND TREATMENT OF RELEASE MATERIAL

The Spill Prevention and Response Plan should be referenced for this information.

G-4g POSTEMERGENCY EQUIPMENT MAINTENANCE

The Spill Prevention and Response Plan should be referenced for this information.

G-4h CONTAINER SPILLS AND LEAKAGE

Any container spills or leakage which might occur at these units will be managed in accordance with the Holloman Spill Prevention and Response Plan.

G-4i TANK SPILLS AND LEAKAGE -- Not Applicable.

G-4j WASTE PILE SPILLS AND LEAKAGE -- Not Applicable.

G-4k SURFACE IMPOUNDMENTS, SPILL LEAKAGE, AND SUDDEN DROPS - - Not Applicable.

G-4l LANDFILL LEAKAGE -- Not Applicable.

G-5 EMERGENCY EQUIPMENT

These items will be available for EOD activities:

- first aid kit (NSN-654500-116-1410) or suitable substitute;
- ambulance or first aid vehicle;
- fire extinguisher: two per vehicle carrying class B/C explosives
- hand-held radio for contact with range control;
- vehicular radio for contact with Holloman AFB;
- team chief's response kit with maps;
- road kit: on per vehicle;
- general purpose tool kit;
- signal kit;
- pioneer tool kit (if required for specific treatment event);
- road flares;
- shovels: two per vehicle; and
- bulldozer.

G-6 COORDINATION REQUIREMENTS

In addition to the base organizations and personnel assigned to the response effort, provisions have been made for including off-base organizations in the response organization when on-base spill response resources and expertise are insufficient, and when off-base water, land, or air are adversely affected. Some of the significant off-base spill response resources that can be incorporated, as needed, are discussed in the paragraphs below.

a. Air Combat Command (ACC/CEV): MAJCOM office responsible to ensure environmental protection including spill response matters. This office located at Langley AFB, VA and can be reached at DSN 574-2601 or

commercial 804-764-2601.

b. Air Force Engineering and Services Center (AFESC): The Air Force Engineering and Services Center is assigned the responsibility to provide technical guidance and assistance to major commands and bases in contingency operations and environmental planning. Technical expertise can be provided to the Air Force OSC on hazardous material identification, control, cleanup, and disposal. The AFESC/CEVP is located at Tyndall Air Force Base, Florida, and can be contacted at DSN 970-6167 or commercial (904) 283-6167.

c. State of New Mexico Response Team: The State of New Mexico Environment Department (NMED) has developed an Emergency Response Team to respond to spills occurring within the state boundaries. The state OSC will be briefed fully by the base OSC on the spill response. The state OSC will be familiar with the available sources of spill response. Equipment and materials within New Mexico. The NMED emergency response team phone number is (505) 827-9239.

d. City of Alamogordo Fire Department: Holloman AFB has mutual aid agreement with the city of Alamogordo Fire Department to provide assistant in the event it should be needed.

e. White Sands Missile Range: Certain information services are also available to assist in the event of an emergency. The include:

- CHEMTREC
- CHRIS Manual
- ETRIS
- OHMTAPS
- U. S. Air Force Occupational and Environmental Health Laboratory

Further information on these services is provided in the Spill Prevention and Response Plan.

G-7 EVACUATION PLAN

It is extremely unlikely that emergency operation at these units would require evacuation of other areas at Holloman AFB since these units are isolated from any other area or office buildings.

The general base excavation plan is provided as part of the Disaster Preparedness Plan (Exhibit G-2).

G-8 REQUIRED REPORTS

The emergency coordinator will notify the Holloman AFB Environmental Coordinator (49th CES/CEV) who will report at pollution incidents as necessary.

Notification by the environmental coordinator (DEV):

1. All pollution incidents will be reported as soon a practicable (by telephone during duty hours or by message during off-duty hours) to the following agencies:

a. HQ ACC/CEV
. DSN 574-2601; commercial (804) 764-2601

b. Regional Response Center
Environmental Protection Agency, Region VI
First Interstate Bank Tower
1445 Ross Avenue
Dallas, TX 75202-2733
(214) 767-2666/2720
Telex 910-861-4125

c. New Mexico Environment Department
1-(505)-827-9239

2. Major spills or potential manor spills will immediately reported by telephone and teletype to RRC (1.b above) and:

National Response Center
Environment Protection Agency
Nasiff Building
400 7th Street, S.W.
Washington, D. C. 20590
1-800-424-8802
Telex 426-0014

Medium spills will be reported to the above agencies as soon as practical.

EXHIBIT G-1

Holloman AFB SPILL PREVENTION RESPONSE PLAN
(applicable sections)

EXHIBIT G-2
HOLLOMAN AFB DISASTER PREPAREDNESS PLAN

SECTION H
PERSONNEL TRAINING

H-1 OUTLINE OF TRAINING PROGRAM

Facility personnel who handle hazardous wastes must successfully complete a program of classroom instruction and/or on -the-job-training in order to prepare them to operate and maintain the facility/unit in a manner which ensures that facility's compliance with RCRA training requirements.

All DoD EOD personnel attend the Explosive Ordnance School at Indian Head Naval Ordnance Station, Indian Head, MD. Explosive Ordnance School incorporates hazardous waste management training for the specific wastes that are treated in the unit. This is the single training point for all military personnel in the EOD career field. Senior EOD personnel also support this training with on-the job training and close supervision.

H-1a JOB TITLES AND DUTIES

EOD supervisor personnel at Holloman AFB are directly responsible for the proper handling of explosive ordnance. The duties, responsibilities, and qualifications of these position are as follows:

Air Force EOD Supervisor

Responsibilities: Directs the operations at the EOD section at Holloman AFB. The EOD supervisor provides assistance and guidance on explosive ordnance disposal and management at the EOD areas.

Duties:

1. Plans, coordinates, and directs all EOD operations at Holloman AFB. Interprets regulations and develops necessary operating procedures as required. Determines requirements for manpower, space, and equipment and initiates actions required. Determines need for modifications to existing facilities and initiates action to improve economy, efficacy safety, and physical security of operations. Develops appropriate requirements and initiates requests for work.

2. Personal contacts: Maintains personal contacts with local and state government agencies and military commands.

3. Work assignment and review: Assigns work to subordinate employees or supervisors based on priorities. Makes decisions on work problems referred by subordinate supervisors. Assures that workload and project responsibilities are specifically delegated and assigned to subordinates.

H-1b TRAINING CONTENT, FREQUENCY, AND TECHNIQUES

H-1b-(1) EOD TRAINING PROGRAM

This program is taught at Indian Head, MD, and is for all EOD personnel within DoD. All personnel must pass the basic course and supervisor personnel must pass the two additional advanced courses. All EOD personnel are required to complete annual reviews of the basic course. The course outline is as follows:

1. Explosive Ordnance Disposal Specialist/Technician Career Field
- **A**. Progression in career ladder 464X0
- **B**. Duties of AFSCs 46430/50/70

2. Security
- **A**. Communications Security (COMSEC)
  - **(1)** Classify information and use MAJCOM/SOA EEFIS
  - **(2)** Prevent security violations
  - **(3)** observe security precautions
- **B**. Operations Security (OPSEC)
  - **(1)** Background and history of OPSEC
  - **(2)** Definition of OPSEC
  - **(3**) Relationship of OPSEC to other security programs including COMSEC, Information Security, and Physical Security
  - **(4)** Common OPSEC vulnerabilities
  - **(5)** OPSEC significance of unclassified data and procedures
  - **(6)** Specific OPSEC vulnerabilities of AFSC 464-X0
- **C.** Resource Security
  - **(1)** EOD publications
    - **a.** Storage requirements
    - **b.** Control/Access procedures
    - **c.** Destruction/Disposition requirements
  - **(2)** Protection of firearms and munitions
  - **(3)** Arming and use of force by USAF personnel

3. Air Force Occupational Safety and Health
- **A.** The USAF safety program
- **B.** Principles pertaining to:
  - **(1)** Ground safety
  - **(2)** Explosives and missile safety
  - **(3)** Nuclear surety
- **C**. Investigate and report USAF mishaps

4. Publications
- **A.** USAF publications
- **B**. USAF technical orders (TO)

(1) USAF TO system
(2) Use indexes (NI & RI)
(3) Locate desired information
(4) Use TOs when performing tasks
(5) Establish and maintain TO files
(6) Initiate TO improvement reports
(7) Requisition TOs

5. Participate in USAF Graduate Evaluation Program

6. Management
- **A.** EOD Unit Management
  - **(1)** Organizational structure
  - **(2)** Functions and responsibilities
- **B.** Inspection system
- **C.** Material deficiency reporting

7. Applied principles of Physics
- **A.** Properties of matter
- **B.** Laws of motion
- **C.** Simple machines
- **D.** Measurement systems
  - **(1)** English
  - **(2)** Metric
  - **(3)** Convert from system to system

8. Fundamentals of Electricity
- **A.** Ohms Law
- **B.** Series circuit
- **C.** Parallel circuits

9. EOD Tools
- **A**. Maintain tools
- **B.** Handtools
  - **(1)** Select proper tools
  - **(2)** Use tools properly
- **C.** Special tools
  - **(1)** Select proper tools
  - **(2)** Use tools properly

10. Military Explosives (General)
- **A.** Identification
- **B.** Characteristics
- **C** Effects

11. Destruction of Explosive Material
- **A.** Demolition equipment
- **B.** Firing systems
  - **(1)** Electric
  - **(2)** Non-Electric
- **C.** Disposal procedures
  - **(1)** Routine
  - **(2)** Emergency

- **D.** Munitions residue
  - **(1)** Inspect
  - **(2)** Certify
  - **(3)** Turn-in
- **E.** Environmental considerations
- **F.** Transport munitions

12. Render Safe Techniques
- **A.** Immobilize fuzes
- **B.** Remove fuzes by remote means
- **C.** Disable electrical components
- **D.** Disrupt firing trains
- **E.** Use shaped charges and demolition techniques

13. Chemical Warfare Agents
- **A.** Classification
  - **(1)** Physical state
  - **(2)** Tactical use
  - **(3)** Physiological action
  - **(4)** Persistency
- **B.** Use protective clothing and equipment
- **C.** Downwind hazards
- **D.** Use detection and identification kits
- **E.** Apply first aid/self air procedures
- **F.** Use decontaminants and decontamination equipment

14. Chemical Munitions
- **A.** Munitions characteristics
- **B.** Identify
- C. Seal and package leaking munitions
- **D.** Respond to incidents involving chemical munitions
- **E.** Transport hazardous chemical munitions
- **F.** Use disposal methods

15. Placed Munitions
- **A.** Land mine and fuzes
  - **(1)** Classification
  - **(2)** Identification
- **B.** Booby traps and fuzes
  - **(1)** Classification
  - **(2)** Identification
- **C**. Locate
  - **(1)** Land mines
  - **(2)** Booby traps
- **D.** Placed munitions and their fuze
  - **(1)** Render safe
  - **(2)** Disposal
- **E.** Placed munitions of foreign countries

16. Projected Munitions, Rockets, and Grenades
- **A.** Projected munitions and their fuzes
  - **(1)** Classifications
  - **(2)** Identification
  - **(3)** Locate
  - **(4)** Render safe
  - **(5)** Disposal
- **B.** Projected munitions, rockets, and grenades of foreign countries

17. Dropped Munitions
- **A.** Bombs
  - **(1)** Classification
  - **(2)** Identification
  - **(3)** Render safe
  - **(4)** Disposal
- **B.** Bomb clusters and dispensers
  - **(1)** Classification
  - **(2)** Identification
  - **(3)** Render safe
  - **(4)** Disposal
- **C.** Fuses
  - **(1)** Classification
  - **(2)** Identification
  - **(3)** Render safe
  - **(4)** Disposal
- **D.** Dropped munitions of foreign countries

18. Aircraft Systems and Explosives
- **A.** Aircraft egress/weapons systems
  - **(1)** Aircraft/egress
  - **(2)** Gun systems
  - **(3)** Release systems
  - **(4)** Missile/rocket launching systems
  - **(5)** Miscellaneous explosive-actuated devices
- **B.** Aircraft explosive devices
  - **(1)** Locate
  - **(2)** Render safe
  - **(3)** Remove
  - **(4)** Disposal

19. Pyrotechnics
- **A.** Classification
- **B.** Identification
- **C.** Render safe
- D. Disposal

20. Guided Missiles
- **A.** Classification
- **B.** Identification
- **C.** Propulsion Systems
  - **(1)** Identification
  - (2) Characteristics
- **D.** Hazardous missile components and propellants
  - **(1)** Identification
  - **(2)** Render safe
  - **(3)** Removal
  - **(4)** Disposal
- **E.** Guided missile of foreign countries

21. Nuclear Weapons
- **A**. Classification
- **B.** Identification
- **C.** Fuzing and firing systems
- **D.** Nuclear weapons and hazardous components
  - **(1)** Render safe
  - **(2)** Disposal
- **E.** Use protective clothing and equipment
- **F.** Use equipment

22. Radiac Instruments, Radiological Monitoring, and Radiological Hazards
- **A.** Principles of RADIAC instruments operation
- **B.** Use RADIAC instruments
- **C.** Perform operator maintenance on RADIAC instruments
- **D.** Compute stay times

23. Explosive Ordnance Reconnaissance
- **A.** Recognition of terrain changes due to unexploded ordnance (UXO)
- **B.** Locate, mark, and report UXOs
- **C.** Incident categories
- **D.** Determine hazard distances
- **E.** Safety requirements
- **F.** Protective works
- **G.** Technical intelligence
  - **(1)** Use photographic equipment
  - **(2)** Reporting

24. Access and Recovery
- **A**. Characteristics of soils
- **B.** Effects of weather on soils
- **C.** Methods of gaining access
- D. Performing field rigging and improvised hoisting

E. Tie knots, bends, and hitches

25. Ranges
- **A.** Decontaminate ranges
  - **(1)** Active
  - **(2)** Inactive
  - **(3)** Excess
- **B.** Proficiency/Demolition ranges
  - **(1)** Establish
  - **(2)** Maintain

26. Improvised Devices
- **A.** Improvised explosive devices (IEDs)
  - **(1)** Identification
  - **(2)** Gain access
  - **(3)** Render safe
  - **(4)** Disposal
- **B.** Radiography interpretation
- **C.** Improvised nuclear devices (IND)

H-1b(2) RCRA TRAINING PROGRAM

All EOD personnel responsible for management and operations at the 20,000lb EOD Area are required to complete the RCRA training program offered at Holloman AFB. The course outline is provided as Exhibit H-1.

H-1c TRAINING DIRECTOR

The EOD supervisor is responsible for ensuring that assigned personnel receive adequate training in handling potentially hazardous wastes. Training directors at the EOD school in Indian Head, MD, are highly trained career specialists who provide the EOD training for all DoD personnel. Instructions for the RCRA course are indicated in Exhibit H-1. Records of previous and ongoing training courses are maintained at the EOD section.

H-1d RELEVANCE OF TRAINING TO JOB POSITION

The EOD supervisory personnel who will be responsible in case of an emergency have been trained in handling explosive ordnance and potentially hazardous waste and in responding to emergency situations. Each has attended the EOD school course at Indian Head Naval Ordnance Station. Completion of the RCRA training course in Exhibit H-1 is also required.

H-1e TRAINING FOR EMERGENCY RESPONSE

The Naval Ordnance Station training program ensures that personnel receive emergency response training. On-the-job training requires each person

to read and understand various official publications including, but not limited to:

AFR 127-100	Explosives Safety Standards
AFOSH Regulation 127-66	General Industrial Operations
Code of Federal Regulations, Title 49	Transportation
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
T.O. 00-5-1	AF Technical Order System
T.O. 11A-1-1	Ammunition Restricted or Suspended
T.O. 11A-1-42	General Instructions for Disposal of Conventional Munitions
T.O. 11A-1-46	Fire Fighting Guidance, Transportation and Storage, Management Data, and Complete Round Charts
T.O. 11A-1-53	General Instructions for Ammunition Color coding, Identification of Empty and Inert Loaded Ammo Items and Components, and Assignment of Version Numbers to training and Dummy Ammunition Items
T.O. 11A-1-60	General Instructions for Inspection of Reusable Munitions Containers and Scrap Material Generated from Items Exposed to or Containing Explosives
T.O. 60 Series	This series is common to all military services. Various titles regarding specific items containing explosive ordnance, e.g., T.O. 60B-2-2-11-4 (Mk 106 Practice Bomb), T.O. 60F-2-2-1-7 (2.75 WP Warhead)

Additionally, EOD personnel responsible for operations at the EOD Area

Are provided additional training in emergency response as a portion of the Holloman AFB training program. This training includes the following applicable Air Force Occupational, Safety, and Health Standards"

AFOSH 111-1
AFOSH 127-31
AFOSH 127-38
AFOSH 127-43
AFOSH 127-66

H-2 IMPLEMENTATION OF THE TRAINING PROGRAM

The EOD supervisor and director of the Holloman AFB RCRA training program will ensure that all EOD personnel have met the training requirements within six months of this assignment at the facility. At the time of the submittal, all EOD personnel have completed the hazardous waste management portion of the training program. Training records for both the EOD and RCRA portions of the program are maintained at the EOD and Environmental Planning Branch.

Annual reviews and updates are required for both the EOD and hazardous waste management portions of the program. Records that specify the job title, duties, and progression in the training programs are maintained at the EOD branch. These records are maintained during tenure of the personnel at Holloman AFB.

EXHIBIT H-1

HAZARDOUS WASTE TRAINING OUTLINE

HAZARDOUS WASTE TRAINING OUTLINE

1. This training is provided primarily to accumulation/satellite accumulation point managers. Personnel who handle hazardous waste also receive this training. This course is designed to fulfill, in part, the requirements of 40 CFR 265.16. It is not intended to fulfill the requirements of 29 CFR 1910.120.

2. The following material is covered during the class:

A. Introduction RCRA

B. Definition of Hazardous Waste
- characteristics
- listed wastes

C. Accumulation point managers

D. Container use, marking, labeling and on base transportation

E. Contingency planning and emergency response.

SECTION I

CLOSURE PLANS, POSTCLOSURE PLANS, AND FINANCIAL REQUIREMENTS

I-1 CLOSURE PLANS

The 20,000lb Ed Area site is located in the northwest portion of the Holloman AFB boundary. Figures B-3 and B-4 fulfill the topographic map requirements and indicate the position of the unit within the base property.

The 20,000lb ED Area site is used to provide treatment to waste propellant compositions. Posttreatment inspections ensure that all energetic materials are treated. Additionally, sampling protocols, described in Section C, are designed to confirm that all energetic wastes are destroyed and that hazardous residuals do not remain in the area. Both residuals do not remain in the area. Both the residuals and underlying soils are sampled to confirm treatment effectiveness and to ensure that no hazardous wastes are disposed of. As a result of these factors, this closure plan presupposes "clean closure." If sampling results indicate that clean closure cannot be achieved, a modification to the closure plan will be submitted 60 days prior to the date scheduled for initial closure actions.

I-1a CLOSURE PERFORMANCE STANDARD

This closure plan is designed to ensure that the unit will not require further maintenance, minimize the threat to human health and environment, and control or eliminate the escape of hazardous waste, hazardous constitutes, leachate, contaminated runoff, or decomposition products. This standard is met in the following manner:

1. During the active life of the unit, the posttreatment residuals and soils are sampled to demonstrate treatment effectiveness and ensure that residuals are nonhazardous.
2. During the interim period between treatment events, the residuals in the unit remain covered in order to retard leachate formation and prevent wind dispersal.
3. Annually, residuals and soils are sampled for characteristics of hazardous waste and suspected hazardous constituents. Residuals and soils that do not meet the criteria specific in Section D are removed from the unit until the underlying soil base is "clean". Residuals and soils that are within the acceptable range are covered with natural fill.
4. The results of the sampling will be submitted to NMED during the unit's active life.

I-lb PARTIAL AND FINAL CLOSURE ACTIVITIES

The closure of the 20,000lb ED Area site is a partial closure that involves closure of only this unit. Closure of all Treatment, Storage, or Disposal Facilities (TSDFs) at Holloman AFB will occur conjunctively with cessation of all base activities. This partial closure will be consistent with the general closure performance standards of 40 CFR 264.601. Coverage after us that occur during the active life of the unit are not considered partial closure. The anticipated date for initiation of these closure activities is January 1, 2050.

I-1c MAXIMUM WASTE INVENTORY

No inventory of waste will be present at the 20,000lb ED Area site at the time of closure. The total mass limit per treatment event is 20,000 pounds. The percentage of energetic material in propellant devices is estimated to range from 40 to 50% of the total mass. Consequently, the probable total energetic mass seldom exceeds 10,000 pounds.

I-1d INVENTORY REMOVAL, DISPOSAL, OR DECONTAMINATION OF EQUIPMENT

After the final treatment, residuals and soil samples will be taken in the final pit of the unit to demonstrate that no hazardous wastes remain and that hazardous constituents have not migrated during the active life of the subunit. If sampling results indicate otherwise, residuals and soils will be handled in the manner specified for the active life. The method for removal, disposal, and equipment decontamination, if required, is specified below.

I-1d(1) CLOSURE OF CONTAINERS -- Not Applicable
I-1d(2) CLOSURE OF TANKS -- Not Applicable
I-1d(3) CLOSURE OF WASTE PILES -- Not Applicable
I-1d(4) CLOSURE OF SURFACE IMPOUNDMENTS -- Not Applicable
I-1d(5) CLOSURE OF INCINERATORS -- Not Applicable
I-1d(6) CLOSURE OF LAND TREATMENT ZONE -- Not Applicable
I-1d(7) CLOSURE OF LANDFILLS -- Not Applicable
I-1d(8) CLOSURE OF MISCELLANEOUS UNITS
I-1d(8) (a) COVERAGE AFTER USE

As previously described, the underlying soils that remain in the pit are sampled and analyzed annually according to the protocols described in Section C. If the analytical results indicate that the residuals are hazardous, the residuals are removed from the pit. Prior to coverage underlying soils are sampled and analyzed at depths of approximately 1 foot intervals for the set of parameters as indicated in Section C. If these results indicate the soils are contaminated above the criteria listed in Section D, both the residuals and the soils will be excavated to a depth of approximately 1 foot. The removal, disposal, and decontamination procedures are summarized below.

STEP 1 - INITIAL SAMPLING

Following a treatment event and prior to coverage after use, residuals and soils are examined according to Section C. After annual sampling, if the soils are not contaminated, the unit is continued to be used. If sampling results indicated that residuals are hazardous or that underlying soils are contaminated, the remainder of the steps in this section are performed.

STEP 2 - REMOVAL

Residues and soil will be excavated to a depth of approximately 1 foot and containerized for disposal as hazardous waste in a permitted TSDF. Prior to disposal, these wastes will be stored in the Defense Reutilization and Marketing Office (DRMO) container storage facility. After removal of the first 1 foot of soil, random coring of soils under the trench will be taken with a hand-held auger to a depth of approximately 1 foot and composited for analysis. Locations were determined or described in Section C. If results indicate that criteria are not met in the first 1 foot, these soils will be removed by standard excavation equipment and managed as hazardous waste. Sampling and removal will proceed in 1-foot layers until the criteria described in Section D are met. Results from analysis of each layer will be submitted to NMED.

STEP 3 - BACKFILLING

Once the criteria in Section D are met, the excavation will be backfilled with clean soil. The top layer will consist of mixed soil (gypsum layers and topsoils, mounded to a height of approximately 12 inches, and compacted by a minimum of 5 blade passes. The closed subunit will be identified with 1-foot metal markers along all four sides.

STEP 4 - DECONTAMINATION

Upon completion of removal, all equipment used during the closure will be emplaced upon a linner that is brought to the area. This temporary base will be diked prior to equipment decontamination. All equipment will be decontaminated by steam cleaning. All rinsewaters will be collected, sampled for parameters of Section C, and if these criteria are exceeded, the rinsewaters will be handled as hazardous waste by storage at the DRMO facility and disposal at a permitted TSDF.

This form of closure is somewhat analogous to closure of a single cell in a landfill and a schedule for closure in this manner is not required. As indicated, all analytical results will be submitted to NMED and backfilling will not proceed until approval is granted.

I-1d(8) (b) - UNIT CLOSURE

The manner of operation for this unit indicates a strong probability that clean closure will be attainable. The steps taken to assure clean closure are described below.

STEP 1 - INITIAL SAMPLING

Ninety (90) days prior to the final treatment activities, soil coring samples will be taken by an auger-boring apparatus to a depth of >15 feet. Coring samples will be taken at 10-foot intervals. Sampling locations will be selected by division of the pit area into approximately 1000 grids of equal size and randomly determined in a manner similar to that described in Section C.

STEP 2 - MODIFICATION OF PLAN 1 CLOSURE NOTICE

In the unexpected event that sampling results indicate contaminant migration, a modified closure plan will be submitted to NMED. This plan will be based upon the extent and nature of contamination in the underlying media. The modified closure plan will be submitted to NMED 60 days prior to initiation of closure activities. If initial sampling results indicate "clean" closure is attainable, these results and a closure notice will be submitted 60 days prior to closure.

STEP 3 - FINAL TREATMENT/CLOSURE OF FINAL SUBUNIT

The final treatment event will performed as previously described. The posttreatment and subunit closure results will be submitted.

STEP 4 - CLOSURE

Clean closure will be achieved by grading of topsoils to retard erosion and runoff. To the extent practical, vegetative cover will be established. The area will be posted to indicate its previous use in a manner analogous to the current posting. Security procedures will be maintained.

STEP 5 - CERTIFICATION OF CLOSURE

Closure will be certified by an independent professional engineer who has had access to the closure plan, final subunit closure results, analysis of the soil cores, and the subunit during the closure activity. Certification of closure will be submitted to the NMED by registered mail within 60 days of completion of the closure action.

I-1e CLOSURE OF DISPOSAL UNITS -- Applicable

I-1f SCHEDULE FOR CLOSURE

A schedule for the closure of the unit is provided as Table I-1. Closure will be achieve within 180 days of the final waste treatment. The anticipated date for closure is January 1, 2050.

I-1g EXTENSION FOR CLOSURE TIME

No extension for closure time anticipated; however, if an extension is necessary to properly close the 20,000 ED Area, then a petition will be sent amending the Table I-1 closure schedule. This petition will demonstrate:

1. the need for more that 180 days to close the site,
2. the reasonable likelihood that a person other than the owner/operator will recommence operation of the site, and
3. that closure would be incompatible with continued operation of Holloman AFB.

I-2 POSTCLOSURE -- Not Applicable

I-3 NOTICE IN DEED -- Not Applicable

I-4 CLOSURE COST ESTIMATE

This facility is federally owned and exempt from this requirement

I-5 FINANCIAL ASSURANCE MECHANISM -- Not Applicable

I-6 POSTCLOSURE COST ESTIMATE

This facility is federally owned and exempt from this requirement.

I-7 FINANCIAL ASSURANCE MECHANISM FOR POSTCLOSURE -- Not Applicable.

I-8 LIABILITY REQUIREMENTS -- Not Applicable
I-9 STATE MECHANISM -- Not Applicable

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TABLE I-1: SCHEDULE FOR CLOSURE OF 20,000 ED AREA

Action	Day Completed
Initial sampling	-120
Modification of plan/closure notice	-60
Last waste treatment/subunit closure	-30
Closure begins	0
Grade and establish cover	90
Certify closure	180
Submission of certification	235

SECTION J-1
CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS

During the period from August 1-12, 1988, representatives of EPA, Region VI were present at Holloman AFB to conduct a RCRA facilities assessment. The results of this assessment are included in "RCRA Facility Assessment, Preliminary Review/Visual Site Inspection Report, Holloman AFB, Nm EPA, I>D> #6572124422:, prepared for U>S> EPA Region VI by A. T. Kirney, Inc. and DPRA, September 1988.

SECTION K-1

OTHER FEDERAL LAWS

Information will be provided in accordance with the requirements of 40 CFR part 270.14(b) (20) at the request o f the New Mexico Department of Health and Environment. At this time, however, this facility is belied to be in compliance with the following federal laws: Wild and Scenic Rivers Act, National Historic Preservation Act of 1966, Endangered Species Act, Coastal Zoane Management Act, and the Fist and Wildlife Coordination Act.

SECTION L-1

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: _____

Title Deputy Base Civil Engineer

Date: October 26, 1992

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

August 29, 1996

Howard E. Moffitt
Deputy Base Civil Engineer
49 CES\CEV
550 Tabosa Ave
Holloman Air Force Base, N.M. 88330-8458

SUBJECT:Notice of Deficiency (NOD): 300-Pound Open Burn Unit. EPA I.D. Number NM6572124422

Dear Mr. Moffitt:

The Hazardous and Radioactive Materials Bureau (**HRMB**) of the New Mexico Environment Department (**NMED**) has reviewed for technical adequacy, the Holloman Air Force base (**HAFB**) October 1992 Closure Plan for the 300 pound Open Burn (**OB**) treatment unit as required under the New Mexico Hazardous Waste Management Regulations.

After reviewing the Closure Plan, the NMED has found the Closure Plan to be technically deficient. The enclosed Attachment A lists the required information necessary for NMED to declare the Closure Plan technically adequate and to consider it for approval.

The information requested in Attachment A must be submitted to NMED within thirty (30) days of receipt of this NOD. Please present the required information in hard copy and on a 3.5" diskette compatible with Word Perfect 5.2. Failure to submit the required information in this designated time may result in issuance of a Notice of Violation (NOV).

If you have any questions regarding this matter you may contact Mr. Cornelius Amindyas at (505) 827-1561.

Sincerely,

Benito Garcia, Chief
Hazardous and Radioactive Materials Bureau

cc: Barbara Hoditschek, HRMB
David Neleigh, EPA Region 6
Files: Red and Reading 96

ATTACHMENT A

Notice of Deficiency for HAFB Open Burn Closure Plan

August 29, 1996

I.A.Topographic Map as required in 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(19).

The Closure Plan must include a map or maps that:

1. show the terrain for a distance of 1,000 feet outside the unit at a map scale of 1 inch equal to not more than 200 feet with appropriate contour lines;

2.a wind rose diagram showing prevailing wind directions and velocities;

3.the legal boundaries (and title) of the unit;

4. access control to the OB treatment unit;

5.any on-site or off-site wells, buildings, and drainage and flood control barriers; and

6.locate the treatment unit, buildings on- and off-site, public roadways, and passenger railways.

7.enumerate any Solid Waste Management Units (SWMUs) that are in the vicinity of the OB unit.

II.A.Closure Permit application as required in 20 NMAC 4.1.600 incorporating 40 CFR §265.112 through §264.115.

The closure plan must:

1.describe the procedures for removal of hazardous waste, residues or post investigation derived waste, and contaminated soils including the location of disposed soils when removed;

2.define methods for sampling and testing surrounding soils and criteria for determining decontamination levels;

Protection of Ground Water

Additional Information requirements as required by 20 NMAC 4.1.600 incorporating, 40 CFR §265.90 (c)

A. Hydrology as required in 20 NMAC 4.1.900 incorporating 40 CFR §270.23(b). The Closure Plan must describe the hydrology below the open burn unit. (This may be available through published or private reports. Provide copies of the references used.).

B. Provide site-specific data for initially characterizing the OB unit and surrounding area. Hydrology and geology supportive of published reports must be confirmed through direct methods of data collection. Any saturated zones must be identified. Discuss appropriate spacial and temporal intervals for soil sample data collection prior to initiating any data collection program.

C. Soil Monitoring as required in 20 NMAC 4.1.500 incorporating 40 CFR 264.601(A)(2) and 40 CFR §270.23(b).

The Closure Plan must:

1. contain the proposed soil monitoring program, including sample collection, sample preservation and shipment, sampling and analysis procedures, and chain of custody control;

2. indicate the parameters selected and the EPA approved or equivalent acceptable analytical method for each parameter;

3. describe background values for each proposed monitoring parameter or constituent; and

4. describe the proposed sampling, analysis and statistical comparison procedures.

If HAFB wishes to pursue a ground water monitoring waiver, HAFB must satisfy all applicable regulations listed below, CFR §265.90 (c) and submit this waiver to HRMB within the timelines outlined above for review.

1. All or part of the ground water monitoring requirements of this subpart may be waived if the owner can demonstrate that there is a low potential for migration of hazardous waste or hazardous waste constituents from the facility via the uppermost aquifer to water supply wells (domestic, industrial, or agricultural) or to surface water.

This demonstration must be in writing and must be kept at the facility. This demonstration must be certified by a New Mexico independently registered professional engineer and must establish the following:

(1) The potential for migration of hazardous waste or hazardous waste constituents from the facility to the uppermost aquifer, by an evaluation of :

(i) a water balance of precipitation, evapotranspiration, runoff, infiltration; and

(ii) unsaturated zone characteristics (i,e., geologic materials, physical properties, and depth to ground water); and

(2) The potential for hazardous waste or hazardous waste constituents which enter the uppermost aquifer to migrate to a water supply well or surface water, by an evaluation of :

(i) saturated zone characteristics (i.e., geologic materials, physical materials physical properties, and rate of ground-water flow); and

(ii) the proximity of the facility to water supply wells or surface water.

PUBLIC SERVICE ANNOUNCEMENT

November 8, 1996

The Director
Public Service Announcement
Radio Station KYEE
P.O. Box 1848
Alamogordo, New Mexico 88310

Dear Sir/Madam:

Please announce over Radio Station KYEE, between 7:00 am and 6:00 pm, Thursday through Wednesday (November 21, 1996 through November 27, 1996), the following public service announcement:

The New Mexico Environment Department is proposing that Holloman Air Force Base Closure Plan be granted for a 300 pound Open Burn Treatment Unit. The Open Burn Treatment Unit is located 9 miles west of the City of Alamogordo, Otero County, southcentral New Mexico.

Copies of the draft Closure Plan are available for review at:

NMED Hazardous and Radioactive Materials Bureau,
2044 Galisteo Street
Santa Fe, New Mexico 87505
Mondays through Fridays from 8:00 am to 5:00 pm.

Alamogordo Public Library
920 Oregon Street
Alamogordo, New Mexico 88310
Mondays through Thursdays from 10:am to 8:00 pm, Fridays and and Saturdays from 11: am to 5:00 pm, and on Sundays from 1:00 pm to 5:00 pm

If you have comments on this draft Closure Plan or you feel that a public hearing should be held, contact Mr. Cornelius Amindyas at (505) 827-1561 no later than December 21, 1996.

If there are charges for this service, please make the announcement only once. If there are no charges, we would appreciate as many announcements beyond the initial one as you may find suitable.

Please submit a certificate of the date(s) and time(s) of the announcements and any bill to:

Ms. Chika Ezeanyim
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street
P.O. Box 26110
Santa Fe, New Mexico, 87502

Thank you for your assistance. If you have any questions regarding the above announcement, please contact Mr. Cornelius Amindyas of my staff at (505) 827-1561.

Sincerely,

Stu Dinwiddie, Manager
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau

cc: Benito Garcia, Chief, HRMB
File Red, 96
File, Reading, 96

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 8, 1996

Ms. Sarah Geary
Director,
Legal Department
Alamogordo Daily News
P.O. Box 870
Alamogordo, New Mexico 88310

Dear Ms. Geary:

Please publish the enclosed **Legal Notice # 99** in your **Thursday November 21, 1996** Newspaper:

Please return a copy of the notice as published with a certificate of date published. Address the bill to:

Ms. Chika Ezeanyim
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street
P.O. Box 26110
Santa Fe, New Mexico, 87502

Thank you for your assistance. If you have any questions, please contact Mr. Cornelius Amindyas of my staff at (505) 827-1561.

Sincerely,

Stu Dinwiddie, Manager
RCRA Permits Program
Hazardous and Radioactive Materials Bureau

Enclosure

cc: Benito Garcia, Chief, HRMB
File Red, 1996

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 8, 1996

Mr. Paul Miller
Director
Alamogordo Public Library
920 Oregon Street
Alamogordo, New Mexico 88310

RE: Draft Closure Plan Document Availability

Dear Mr. Miller:

Enclosed is a copy of the draft Closure Plan, Legal Notice, and Fact Sheet for the Holloman Air Force Base 300-pound (**lb**) Open Burn Treatment Unit. Please make these documents available to the public for review during the public comment period which starts on **November 21, 1996** and ends on **December 21, 1996**. I would appreciate it if you could return this copy after the comment period closes.

If you have any questions, please contact Mr. Cornelius Amindyas of my staff at (505) 827-1561.

Sincerely,

Stu Dinwiddie, Manager
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau

Enclosures.

cc: Benito Garcia, Chief, HRMB
File Red, 1996
File, Reading, 96

LEGAL NOTICE # 99

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS AND RADIOACTIVE MATERIALS BUREAU
Santa Fe, New Mexico 87502

November 21, 1996

NOTICE OF INTENT TO APPROVE A CLOSURE PLAN FOR AN OPEN BURN TREATMENT UNIT

The State of New Mexico is authorized to operate a hazardous waste management program in lieu of the Federal program for the Resource Conservation and Recovery Act (**RCRA**) in effect prior to the enactment of the Hazardous and Solid Waste Amendments of 1984 (**HSWA**). The HSWA impose additional requirements on hazardous waste management facilities. The State of New Mexico received additional authorization for the requirements of HSWA effective January 2, 1996.

Under authority of the New Mexico Hazardous Waste Act NMSA 1978 §74-4-1 et. seq. (Repl.Pamp. 1993) as amended, 1989, and the New Mexico Hazardous Waste Management Regulations (20 NMAC 4.1, Effective November 30, 1995), the New Mexico Environment Department (**NMED**) can approve or deny Closure Plans. NMED has received a permit Closure Plan submitted by the **Department of the Air Force, Holloman Air Force Base, EPA I.D. Number NM6572124422**, for a previously active Open Burn Treatment Unit.

The Administrative Record for this draft Closure Plan consists of the draft Closure Plan, a fact sheet, and related correspondence.

The draft Closure Plan may be reviewed at:

NMED Hazardous and
Radioactive Materials Bureau
2044 Galisteo Street
Santa Fe, New Mexico 87505
Mondays through Fridays from 8:00 am to 5:00 pm.

Alamogordo Public Library
920 Oregon Street
Alamogordo, New Mexico 88310
Mondays through Thursdays from 10:am to 8:00 pm, Fridays and and Saturdays from 11: am to 5:00 pm, and on Sundays from 1:00 pm to 5:00 pm

To obtain a copy of the draft Closure Plan or any part thereof, at 35 cents per page, please contact Mr. Cornelius Amindyas at the above Santa Fe address or call (505) 827-1561.

Any person who wishes to comment upon the draft Closure plan or to request a public hearing should submit written comments and requests, along with the commentor's name and address, to the Santa Fe address. Requests for a public hearing shall state the nature of the issues proposed to be raised in the hearing and the name and address of the commentor. Only comments and/or requests received on or before **December 21, 1996** will be considered. NMED will provide a thirty (30) day notice of a public hearing, if scheduled.

NMED must ensure that the approved draft Closure Plan is consistent with the New Mexico Hazardous Waste Management Regulations for Closure Plans. All written comments submitted on the draft Closure Plan will be considered in formulating a final decision. NMED may modify the draft Closure Plan based on the comments received. NMED will notify HAFB each person who submitted a written comment during the public comment period of the final decision.

After consideration of all written comments received, NMED will approve, or modify and approve the Closure Plan. If NMED modifies and approves the Closure Plan, then NMED shall provide HAFB with a detailed written statement of reasons for the modification and the modified Closure Plan will become the approved Closure Plan. A copy of the modified Closure Plan with a detailed statement of the reasons for the modifications will be mailed to HAFB.

300-POUND OPEN BURN (OB) DRAFT CLOSURE PLAN

FACT SHEET

for the

U.S.DEPARTMENT OF THE AIR FORCE, HOLLOMAN AIR FORCE BASE
OB TREATMENT UNIT, OTERO COUNTY, NEW MEXICO

November 8, 1996

Previous Activities:Open Burning (**OB**) thermal treatment (destruction) of explosives and waste munitions. Currently the OB unit is inactive.

Facility Name:Holloman Air Force Base, Alamogordo, New Mexico.

EPA I.D. No.:NM6572124422

Location: The Holloman Air Force Base OB Treatment Unit is located in Otero County in the east-central portion of the HAFB boundary, 9 miles (14 kilometers) west of the City Of Alamogordo in southcentral New Mexico.

Unit Purpose:The objective of the work to be conducted under this Closure Plan is to close a previously active Open Burn treatment unit.

Unit Description: The 300-Pound OB Unit consists of four trenches in a circular area with a diameter of approximately 800 feet. Each trench is approximately 20 feet long, 6 feet wide, and 10 to 12 feet deep. The OB unit was used for thermal treatment of waste munitions in the form of pyrotechnics, propellants, and ordnance compositions from 1988 to 1994. The total net explosive weight of ordnance, incendiary devices, and munitions including projectiles, casings and containment devices that were simultaneously treated in a trench was limited to 1250 lb.

November 8, 1996

Draft Closure Plan
Availability: A copy of the Holloman Air Force Base Open Burn draft Closure Plan is available for public review at:

(1) Alamogordo Public Library, 920 Oregon Street, Alamogordo, New Mexico 88310
Mondays through Thursdays from 10:am to 8:00 pm, Fridays and Saturdays from 11: am to 5:00 pm, and on Sundays from 1:00 pm to 5:00 pm

(2) New Mexico Environment Department (NMED), Hazardous and Radioactive Materials Bureau, 2044 Galisteo Street, Santa Fe, New Mexico 87505 *(Mondays through Fridays between 8:00 am and 5:00 pm)***.**

Requests for public hearing on the draft Closure Plan should include a statement of the nature of the issues proposed to be raised in the hearing and must include the requestor's name and address. Only comments and requests for hearing received by **December 21, 1996** will be considered. The NMED will publish a thirty day (30) notice of a public hearing, if scheduled.

Final Decision: All comments received on the draft Closure Plan during the public comment period will be considered in reaching a final Closure Plan approval decision. The NMED will notify HAFB and each person who submitted a written comment, of any changes made in finalizing the Permit.

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 8, 1996

David Neleigh, Chief
U.S. EPA Region 6
RCRA Permits Branch (6PD-N)
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Dear Mr. Neleigh:

Enclosed is a copy of a draft Closure Plan developed by the New Mexico Environment Department (**NMED**) for the Holloman Air Force Base 300 pound Open Burn Treatment Unit. Also enclosed are copies of the fact sheet, legal notice, and related correspondence. The NMED proposes to proceed with a 30 day public notice on November 21, 1996. The public comment period will end on December 21, 1996. Please submit any comments you may have on the draft Closure Plan to NMED before the 30 day public comment period expires.

If you have any questions on the draft Closure Plan, please contact Mr. Cornelius Amindyas of my staff at (505) 827-1561.

Sincerely,

Stu Dinwiddie, Manager
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau

Enclosures.

cc: File Red, 1996

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 8, 1996

Howard E. Moffitt
Deputy Base Civil Engineer
49 CES\CEV
550 Tabosa Ave
Holloman Air Force Base, N.M. 88330-8458

SUBJECT:Administrative Completeness and Technical Adequacy of the 300-Pound Open Burn Treatment Unit Closure Plan.
EPA I.D. Number NM6572124422

Dear Mr. Moffitt:

The New Mexico Environment Department (**NMED**) Hazardous and Radioactive Materials Bureau (**HRMB**) completed its administrative and technical review of the Holloman Air Force Base (**HAFB**) Open Burn Closure Plan and sent HAFB a Notice of Deficiency (**NOD**) on September 20, 1996.

After reviewing HAFB's response to the NOD, HRMB has determined that all items in the NOD have been sufficiently addressed by HAFB, and the Closure Plan is administratively complete and technically adequate.

NMED will provide the public through a newspaper notice, the opportunity to submit written comments on the subject plan and request modifications to the plan no later than 30 days from the date of the notice, in accordance with 20 NMAC 4.1.600 incorporating 40 CFR §265.112(d)(4). The public comment period will begin on November 21, 1996 and end on December 21, 1996. HAFB is also encouraged to submit any comments they may have to HRMB during the 30 day public comment period.

After the 30 day public comment period has ended, HRMB may, in response to a request, hold a public hearing whenever such a hearing might clarify one or more issues concerning the subject Closure Plan.

After consideration of all written public comments received, NMED will approve, or modify and approve the Closure Plan. If NMED modifies and approves the Closure Plan, then NMED shall provide HAFB with a detailed written statement of reasons for the modification and the modified Closure Plan will become the approved Closure Plan. A copy of the modified Closure Plan with a detailed statement of the reasons for the modifications will be mailed to HAFB.

Thank you for your participation and cooperation in our permitting process. If you have any questions, please contact Cornelius Amindyas of my staff at (505) 827-1561.

Sincerely,

Stu Dinwiddie, Manager
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau

cc:Benito Garcia, Chief, HRMB
David Neleigh, US EPA, Region 6
File: Red 96 and Reading 96