TA 14

Department of Energy

Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

OCT 0 6 1997

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VIA HAND DELIVERY

Robert S. Dinwiddie, Ph.D.
Program Manager/Permitting Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street, Building A
P. O. Box 26110
Santa Fe, NM 87505

Dear Dr. Dinwiddie:

Subject: Submittal of the Revised Part A and Part B Application for Technical Area (TA) 14 (Includes TA-15, 36, and 39), Reflecting the Notice of Deficiency (NOD) Changes and Language Revisions, Making Los Alamos National Laboratory (LANL) OB/OD Units Equivalent to Military OB/OD Units in New Mexico

The purpose of this letter is to submit a revised Part A and Part B application for TA-14. The revisions in this submittal incorporate the NOD response provided to your staff earlier this month, as well as changes to the overall language to reflect the decision to treat LANL OB/OD units the same as the military OB/OD units here in New Mexico.

Regarding the changes precipitated by the NOD response, there is a separate section in Volume 1 to address responses that could not be incorporated into Part A or Part B. For ease of review, we have shaded the newly added material in both Parts A and B.

These revisions are in response to several meetings held between the New Mexico Environment Department (NMED) and LANL in which we discussed the similarities between the military OB/OD operations here in New Mexico and those at LANL. NMED decided that the operations were equivalent and that they should be addressed the same. Therefore we revised the application to reflect that situation.

If you should have any questions concerning this letter or its enclosures, please contact me at (505) 665-5042.

Sincerely,

H. L. "Jody" Plum
Office of Environment

LAAMEP:3JP-065

3 Enclosures

RED LANL TA-14

3867

Document:	LANL OB/OD Part A
Revision No.:	1.0
Date:	October 1997

Part A Permit Application
Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39

Prepared by:
Los Alamos National Laboratory
Hazardous and Solid Waste Group (ESH-19)
Los Alamos, New Mexico 87545

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For EPA Regional Use Only

Date Received
Month Day Year

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** #TA-14, -15, -36 and -39, Rev. 1.0

C. Installation's EPA ID Number: N M 0 8 9 0 0 1 0 5 1 5

D. Secondary ID Number *(If applicable)*:

II. Name of Facility: LOS ALAMOS NATIONAL LABORATORY

III. Facility Location *(Physical address not P.O. Box or Route Number)*

A. Street:

Street *(Continued)*:

City or Town	State	Zip Code
LOS ALAMOS	NM	87545–

County Code (if known)	County Name
028	LOS ALAMOS

B. Land Type (Enter code): F

C. Geographic Location

LATITUDE (Degrees, Minutes, & Seconds)	LONGITUDE (Degrees, Minutes & Seconds)
35 49 051	106 14 015

D. Facility Existence Date

Month	Day	Year
01	01	1943

IV. Facility Mailing Address

Street or P.O. Box: PO BOX 1663

City or Town	State	Zip Code
LOS ALAMOS	NM	87545–

V. Facility Contact *(Person to be contacted regarding waste activities at facility)*

Name (Last)	(First)
TODD	G THOMAS

Job Title	Phone Number (Area Code and Number)
AREA MANAGER	505–665–5027

VI. Facility Contact Address *(See Instructions)*

A. Contact Address: Location [ ] Mailing [X] Other [ ]

B. Street or P.O. Box: 528 35TH STREET

City or Town	State	Zip Code
LOS ALAMOS	NM	87544–

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GSA No. 0248 EPA-OT

EPA I.D. Number *(Enter from page 1)*: N M 0 8 9 0 0 1 0 5 1 5

Secondary ID Number *(Enter from page 1)*:

VII. Operator Information *(See instructions)*

Name of Operator: UNIVERSITY OF CALIFORNIA

Street or P.O. Box: PO BOX 1663

City or Town: LOS ALAMOS

State: NM

ZIP Code: 87545 —

Phone Number *(Area Code and Number)*: 505 — 667 — 5061

B. Operator Type: F

C. Change of Operator Indicator: Yes [ ] No [X]

Date Changed: Month / Day / Year

VIII. Facility Owner *(See instructions)*

A. Name of Facility's Legal Owner: US DEPARTMENT OF ENERGY

Street or P.O. Box: 528 35TH STREET

City or Town: LOS ALAMOS

State: NM

ZIP Code: 87544 —

Phone Number *(Area Code and Number)*: 505 — 667 — 5061

B. Owner Type: F

C. Change of Owner Indicator: Yes [ ] No [X]

Date Changed: Month / Day / Year

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
N	NMR00A384	NPDES Storm Water General Permit
N	NM0028355	NPDES
N	NM0028576	NPDES (Fenton Hill Geothermal Site)
R	NM0890010515	RCRA (Hazardous Waste Permit)
		RAD. NESHAPs Preconstr. Approvals:
E		Low Level Waste/Mixed Waste Incin.
E		Dual Axis Radiographic Hydrotest Fac
E		Ground Test Accelerator
E		Independent Management Activity

EPA I.D. Number
NM0890010515

X. Other Environmental Permits *(continued)*		
A. Permit Type	**B. Permit Number**	**C. Description**
		RAD. NESHAPS PRECONSTRUCTION APPROVALS (Cont'd)
E		Facilitywide Application for Existent Emissions
E		TA-21, D&D Activity
E		TA-50, Bldg. 83 - Mobile Decontamination Trailer
E		TA-54, TRU Retrieval Domes
		STATE AIR QUALITY PERMITS:
E	AQCR 301	Open Burning
E		TA-11 Fuel Fire Burn
E		TA-36 HE-Contaminated Wood Burning
E		TA-14 HE-Contaminated Material Burning
E		TA-16 HE-Contaminated Material Burning
E		TA-33 & TA-39 LIDAR Test Burning
E	AQCR 702	Beryllium Machining
E	#632	TA-35, Bldg. 213, Beryllium Machining Emissions
E	#634-M-1	TA-3, Bldg. 141, Beryllium Processing Emissions
E	#635	TA-3, Bldg. 39, Beryllium Machining Emissions
E	#741	TA-3, Bldg. 35, Planned Beryllium Machining Emissions
E	#1081-M-1	TA-55, Bldg. 4, Beryllium Machining Emissions
		STATE SEPTIC TANK PERMITS:
E	LA-01	State Septic Tank Permit
E	LA-02	State Septic Tank Permit
E	LA-03	State Septic Tank Permit
E	LA-04	State Septic Tank Permit

EPA I.D. Number
NM0890010515

X. Other Environmental Permits *(continued)*

A. Permit Type	B. Permit Number	C. Description
E	LA-05	State Septic Tank Permit
E	LA-06	State Septic Tank Permit
E	LA-07	State Septic Tank Permit
E	LA-08	State Septic Tank Permit
E	LA-09	State Septic Tank Permit
E	LA-11	State Septic Tank Permit
E	LA-12	State Septic Tank Permit
E	LA-13	State Septic Tank Permit
E	LA-14	State Septic Tank Permit
E	LA-15	State Septic Tank Permit
E	LA-16	State Septic Tank Permit
E	LA-17	State Septic Tank Permit
E	LA-18	State Septic Tank Permit
E	LA-19	State Septic Tank Permit
E	LA-21	State Septic Tank Permit
E	LA-22	State Septic Tank Permit
E	LA-23	State Septic Tank Permit
E	LA-24	State Septic Tank Permit
E	LA-25	State Septic Tank Permit
E	LA-26	State Septic Tank Permit
E	LA-27	State Septic Tank Permit
E	LA-28	State Septic Tank Permit
E	LA-29	State Septic Tank Permit
E	LA-30	State Septic Tank Permit

EPA I.D. Number
NM0890010515

X. Other Environmental Permits *(continued)*		
A. Permit Type	**B. Permit Number**	**C. Description**
E	LA-31	State Septic Tank Permit
E	LA-32	State Septic Tank Permit
E	LA-33	State Septic Tank Permit
E	LA-34	State Septic Tank Permit
E	LA-35	State Septic Tank Permit
E	LA-36	State Septic Tank Permit
E	LA-37	State Septic Tank Permit
E	LA-38	State Septic Tank Permit
E	LA-39	State Septic Tank Permit
E	LA-42	State Septic Tank Permit
E	LA-43	State Septic Tank Permit
E	LA-44	State Septic Tank Permit
E	LA-45	State Septic Tank Permit
E	LA-46	State Septic Tank Permit
E	LA-47	State Septic Tank Permit
E	LA-48	State Septic Tank Permit
E	LA-49	State Septic Tank Permit
E	LA-50	State Septic Tank Permit
E	LA-51	State Septic Tank Permit
E	LA-52	State Septic Tank Permit
E	LA-53	State Septic Tank Permit
E	LA-54	State Septic Tank Permit
E	LA-55	State Septic Tank Permit
E	LA-56	State Septic Tank Permit

EPA I.D. Number
NM0890010515

X. Other Environmental Permits *(continued)*

A. Permit Type	B. Permit Number	C. Description
E	LA-57	State Septic Tank Permit
E	LA-58	State Septic Tank Permit
E	LA-59	State Septic Tank Permit
E	LA-60	State Septic Tank Permit
E	LA-61	State Septic Tank Permit
E	LA-124	State Septic Tank Permit
E	SF880257	State Septic Tank Permit
E	SF880258	State Septic Tank Permit
E	SF880259	State Septic Tank Permit
E	SF880260	State Septic Tank Permit
E	SF880261	State Septic Tank Permit
E	SF890023	State Septic Tank Permit
E	SF890024	State Septic Tank Permit
E	SF890025	State Septic Tank Permit
E	SF89031R	State Septic Tank Permit
E	SF89032R	State Septic Tank Permit
E	SF89033R	State Septic Tank Permit
E	SF89034R	State Septic Tank Permit
E	SF89035R	State Septic Tank Permit
E	SF89036R	State Septic Tank Permit
E	SF890588	State Septic Tank Permit
E	SF890589	State Septic Tank Permit
E	SF890590	State Septic Tank Permit
E	SF900022	State Septic Tank Permit

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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)

N M 0 8 9 0 0 1 0 5 1 5

Secondary ID Number (Enter from page 1)

XI. Nature of Business (Provide a brief description)

The principal mission of LANL includes the research, design, development, and analysis of weapons components for the nation's nuclear arsenal. This effort is supported by research programs such as nuclear physics, hydrodynamics, conventional explosives, chemistry, metallurgy, radiochemistry, and biology. In addition to its defense program efforts, LANL supports energy research and environmental missions with programs including medium-energy physics; space nuclear systems; controlled thermonuclear fusion; laser research; environmental research; geothermal, solar, and fossil energy research; nuclear safeguards; biomedical research; and space physics. In 1992, LANL expanded its mission in support of environmental management to include development of new programs in the areas of health and biotechnology, environmental technologies, and industrial partnerships.

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
Gallons	G
Gallons Per Hour	E
Gallons Per Day	U
Liters	L
Liters Per Hour	H
Liters Per Day	V
Short Tons Per Hour	D
Metric Tons Per Hour	W
Short Tons Per Day	N
Metric Tons Per Day	S
Pounds Per Hour	J
Kilograms Per Hour	R
Cubic Yards	Y
Cubic Meters	C
Acres	B
Acre-feet	A
Hectares	Q
Hectare-meter	F
Btu's Per Hour	I

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[illegible]

EPA I.D. Number *(Enter from page 1)*: N M 0 8 9 0 0 1 0 5 1 5

Secondary ID Number *(Enter from page 1)*:

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)	B. 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		.			
2		.			
3		.			
4		.			
5		.			
6		.			
7		.			
8		.			
9		.			
1 0		.			
1 1		.			
1 2		.			
1 3		.			

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 #s in seq w/XII)	A. Process Code (From list above)	B. PROCESS DESIGN CAPACITY 1. Amount (Specify)	B. 2. Unit Of Measure (Enter code)	C. Process Total Number Of Units	D. Description Of Process
X 1	T 0 4				In-situ Vitrification
1	X 0 1	70	See D.	2	Units at TA-14 used for open burning/detonation of explosive hazardous waste. Maximum amount treated by open burning is 50 pounds (lbs.) per burn; maximum amount treated by open detonation is 20 lbs./detonation (det).
2	X 0 1	500	See D.	1	Unit near TA-15-184 used for open detonation of explosive hazardous waste. Maximum amount treated is 500 lbs./det.
3	X 0 1	2,000	See D.	1	Unit near TA-36-8 used for open detonation of explosive hazardous waste. Maximum amount treated is 2,000 lbs./det.
4	X 0 1	2,000	See D.	2	Units near TA-39-6 and TA-39-57 used for open detonation of explosive hazardous waste. Maximum amount treated is 1,000 lbs./det.

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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	0	8	9	0	0	1	0	5	1	5	

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 describes the characteristics and/or the toxic contaminants of those hazardous wastes.*

B. ESTIMATED ANNUAL QUANTITY - *For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.*

C UNIT OF MEASURE - *For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:*

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in column A select the code(s) from the list of process codes contained in Item XII A. on page 3 to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed hazardous waste: For each characteristic or toxic contaminant entered in column A, select the code(s) from the list of process codes contained in Item XII A. on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:

1. *Enter the first two as described above.*
2. *Enter "000" in the extreme right box of Item XIV-D(1).*
3. *Enter in the space provided on page 7, Item XIV-E, the line number and the additional code(s).*

2. PROCESS DESCRIPTION: *If a code is not listed for a process that will be used, describe the process in the space provided on the form (D.(2)).*

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER - Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. *Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B, C and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.*
2. *In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "Included with above" and make no other entries on that line.*
3. *Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.*

EXAMPLE FOR COMPLETING ITEM XIV (shown in line numbers X-1, X-2, X-3, and X-4 below) - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. 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)									(2) PROCESS DESCRIPTION (If a code is not entered in D(1))
X	1	K	0	5	4	900	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												Included With Above

EPA I.D. Number (enter from Page 1)
NM0890010515

Secondary ID Number (enter from Page 1)

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)			D. Processes (2) Process Description (If a code is not entered in D[1])
1	D001	1,000	P	X01			Open Burning (OB) at Technical Area (TA) 14
2	D003						
3	D005						
4	F005						
5	THIS LINE LEFT INTENTIONALLY BLANK						
6	D001	1,000	P	X01			Open Detonation (OD) at TA-14
7	D003						
8	D005						
9	F005						
10	THIS LINE LEFT INTENTIONALLY BLANK						
11	D001	15,000	P	X01			OD at TA-15
12	D003						
13	D005						
14	F005						
15	THIS LINE LEFT INTENTIONALLY BLANK						
16	D001	15,000	P	X01			OD at TA-36
17	D003						
18	D005						
19	F005						
20	THIS LINE LEFT INTENTIONALLY BLANK						
21	D001	15,000	P	X01			OD at TA-39
22	D003						
23	D005						
24	F005						

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EPA I.D. Number (Enter from page 1)

N M 0 8 9 0 0 1 0 5 1 5

Secondary ID Number (Enter from page 1)

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: G. Thomas Todd	Date Signed: 10.8.97
Name and Official Title (Type or print): G. Thomas Todd, Area Manager, DOE/LAAO	
Owner Signature	Date Signed
Name and Official Title (Type or print)	
Operator Signature: G. Thomas Todd	Date Signed: 10.8.97
Name and Official Title (Type or print): G. Thomas Todd, Area Manager, DOE/LAAO	
Operator Signature: [illegible] for DJE	Date Signed: 10/8/97
Name and Official Title (Type or print): Dennis J. Erickson, Division Director, LANL ES&H Division	

XIX. Comments

Note: Mail completed form to the appropriate EPA Regional or State Office. (Refer to instructions for more information)

ATTACHMENT 1

EXPLANATION OF PROCESS CODE LISTINGS AND DESIGN CAPACITIES FOR OPEN BURNING/OPEN DETONATION UNITS AT TECHNICAL AREA (TA) 14, TA-15, TA-36, AND TA-39

EXPLANATION OF PROCESS CODE LISTINGS AND DESIGN CAPACITIES FOR OPEN BURNING/OPEN DETONATION UNITS AT TECHNICAL AREA (TA) 14, TA-15, TA-36, AND TA-39

Line 1 X01 Thermal Treatment - Open Burning/Open Detonation

Description	Capacity (pounds per treatment)	SWMU[a] No.	Associated Structure No./Area
TA-14:			
Thermal treatment unit (open burning)	50	14-005	TA-14-23[b]
Thermal treatment unit (open detonation)	20	14-001(g)	TA-14-23
TOTAL X01 at TA-14	**70**		

See footnotes at end of Attachment 1.

EXPLANATION OF PROCESS CODE LISTINGS AND DESIGN CAPACITIES FOR OPEN BURNING/OPEN DETONATION UNITS AT TECHNICAL AREA (TA) 14, TA-15, TA-36, AND TA-39

Line 2 X01 Thermal Treatment - Open Detonation

Description	Capacity (pounds per treatment)	SWMU[a] No.	Associated Structure No./Area
TA-15:			
Thermal treatment unit (open detonation)	500	15-003	TA-15-184
TOTAL X01 at TA-15	**500**		

See footnotes at end of Attachment 1.

EXPLANATION OF PROCESS CODE LISTINGS AND DESIGN CAPACITIES FOR OPEN BURNING/OPEN DETONATION UNITS AT TECHNICAL AREA (TA) 14, TA-15, TA-36, AND TA-39

Line 3 X01 Thermal Treatment - Open Detonation

Description	Capacity (pounds per treatment)	SWMU[a] No.	Associated Structure No./Area
TA-36:			
Thermal treatment unit (open detonation)	2,000	36-004(c)	TA-36-8
TOTAL X01 at TA-36	**2,000**		

See footnotes at end of Attachment 1.

EXPLANATION OF PROCESS CODE LISTINGS AND DESIGN CAPACITIES FOR OPEN BURNING/OPEN DETONATION UNITS AT TECHNICAL AREA (TA) 14, TA-15, TA-36, AND TA-39

Line 4 X01 Thermal Treatment - Open Detonation

Description	Capacity (pounds per treatment)	SWMU[a] No.	Associated Structure No./Area
TA-39:			
Thermal treatment unit (open detonation)	1,000	39-004(c)	TA-39-6
Thermal treatment unit (open detonation)	1,000	39-004(d)	TA-39-57
TOTAL X01 at TA-39	**2,000**		
TOTAL X01	**4,570**		

Explanation of Symbols/Abbreviations

[a] SWMU = solid waste management unit.

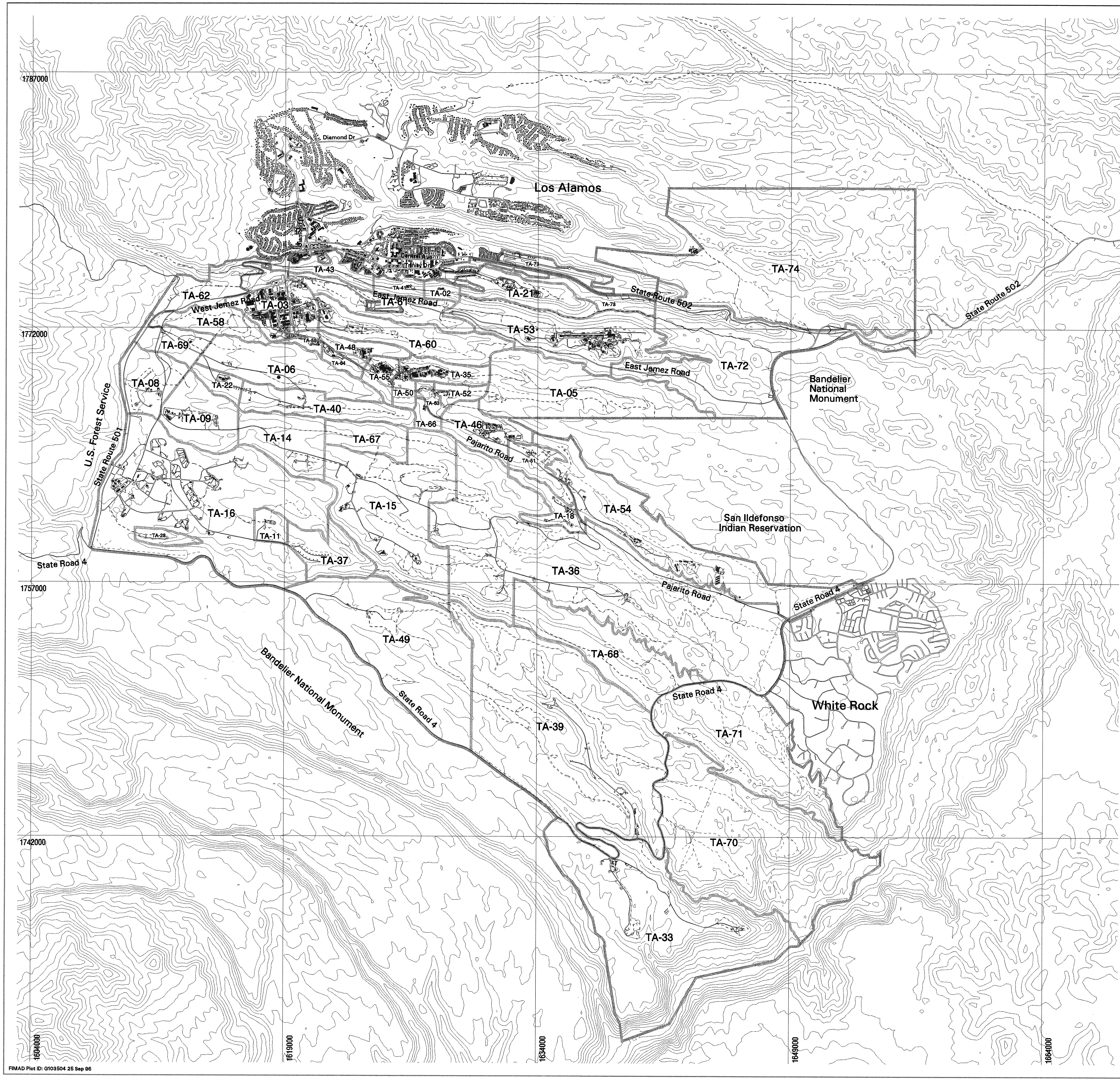
[b] In Los Alamos National Laboratory's Resource Conservation and Recovery Act Part A permit application (LANL, 1988), this unit is described as being associated with Structure No. TA-14-35.

ATTACHMENT 2

TOPOGRAPHIC MAPS

LIST OF TOPOGRAPHIC MAPS

[a] Map 4 has been modified to more clearly delineate the extent of operations at the TA-36 open detonation area.



Map 1: Contour Map Showing All Technical Areas (TA) at Los Alamos National Laboratory (LANL)

- Boundary, LANL
- Boundary, TA
- Contours, 100 foot
- Roads, Dirt
- Roads, Paved
- Trail
- Building

NOTE: TA-57, Fenton Hill Site, not shown

3867-A

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 15000
Feet per inch on map = 3000

SCALE 1:36000

0 914 1828 2742 3656
METERS

0 3000 6000 9000 12000
FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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Earth and Environmental Sciences Division
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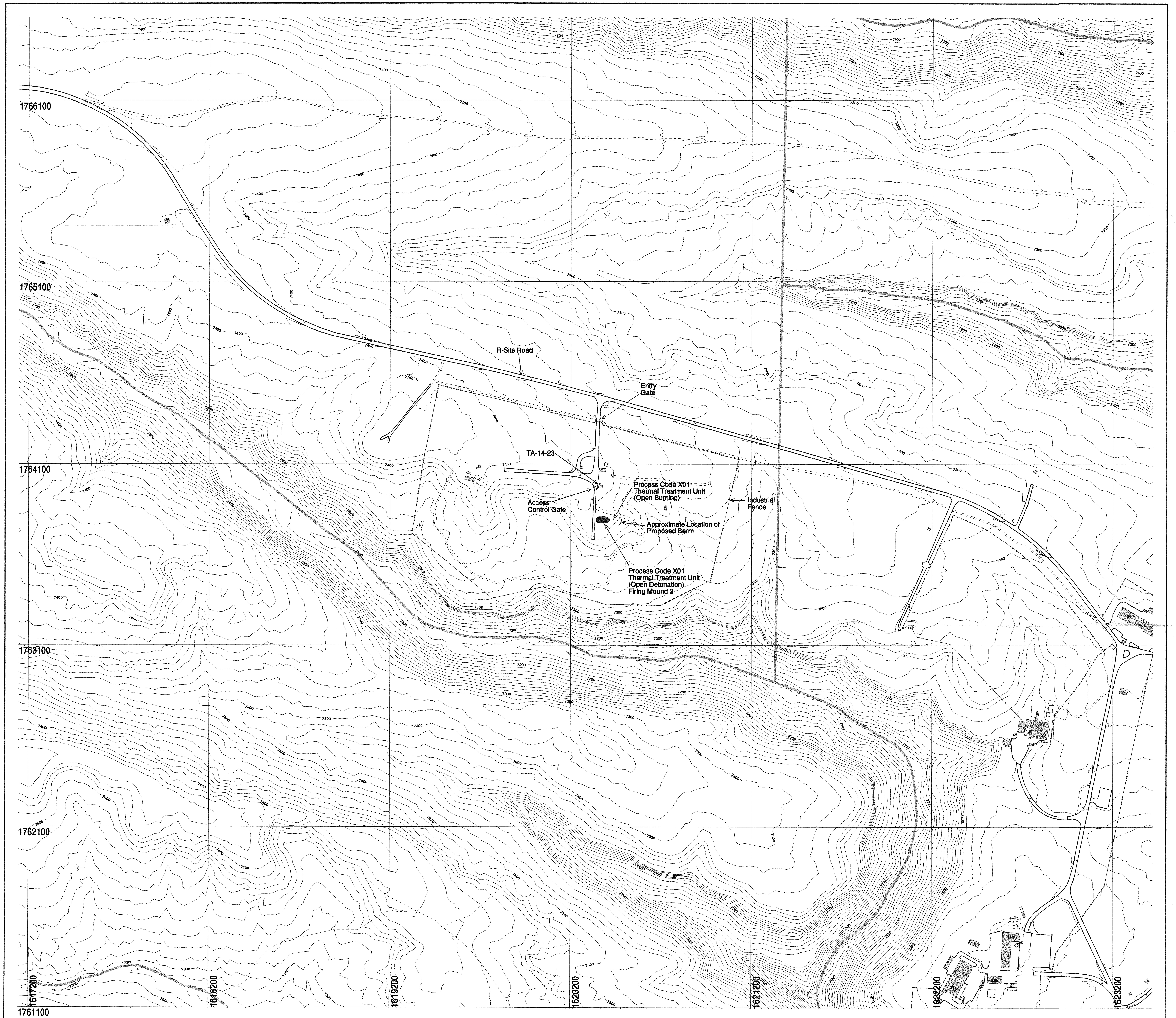
FIMAD is the electronic data repository for the Environmental Restoration Project at Los Alamos National Laboratory.
Produced by: Marcia Jones
Date: September 25, 1996 FIMAD Plot ID: G103504



LEGEND

- Berm, Proposed
- Boundary, TA
- Contour, 10 foot
- Contour, 100 foot
- Fence, Industrial
- Fence, Security
- Road, Paved
- Road, Dirt
- Road/Trail
- Permanent Structure
- Temporary Structure

3867-B

MAP 2:
Contour Map Showing Hazardous Waste Units at Technical Area (TA) 14

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 1000
Feet per inch on map = 250

SCALE 1:3000

0 76 152 228 304
METERS

0 250 500 750 1000
FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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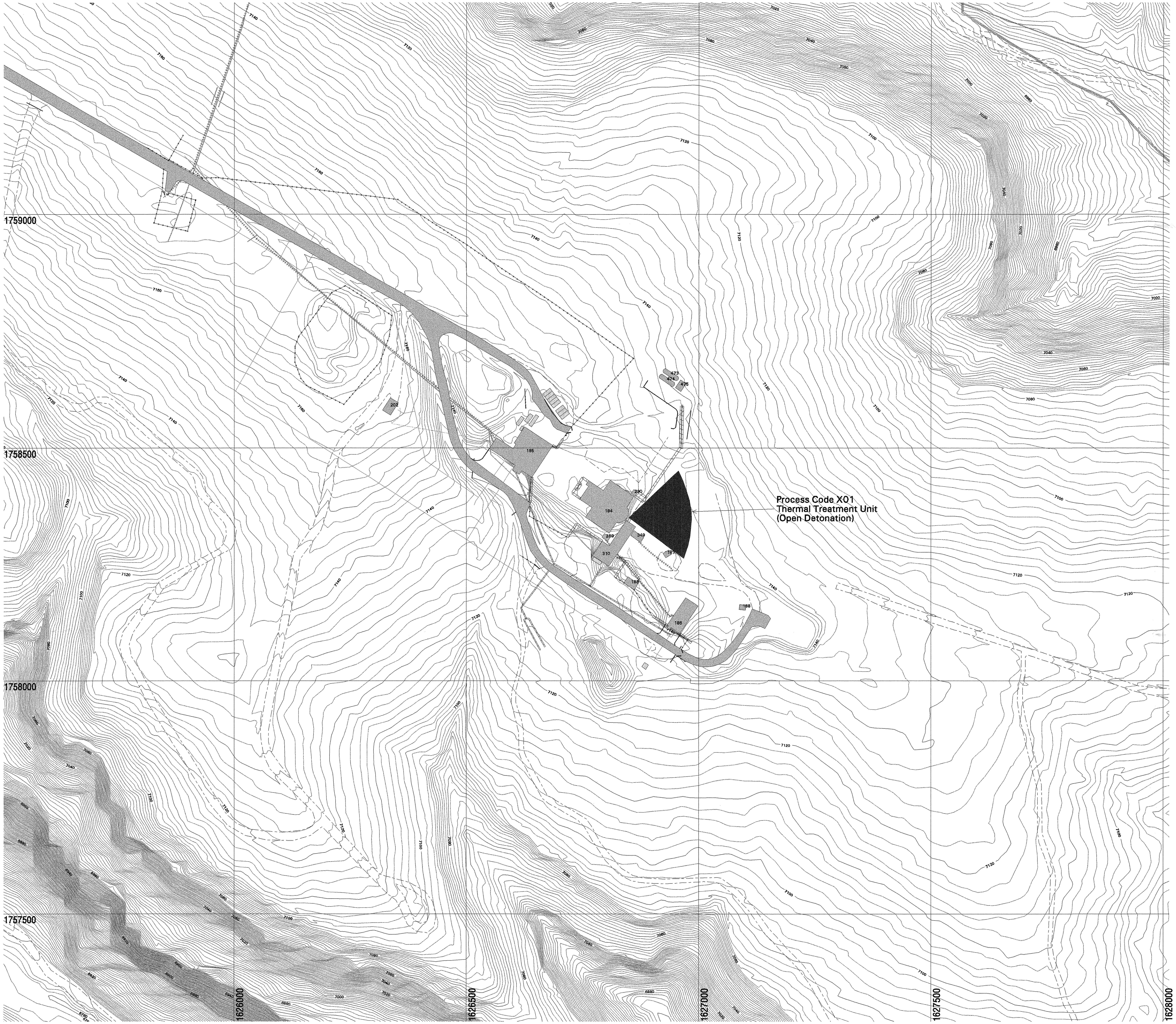
Produced by: Marcia Jones

Date: September 25, 1997 FIMAD Plot ID: G105867



LEGEND

- Boundary, TA
- Contour, 2 foot
- Contour, 10 foot
- Fence, Industrial
- Fence, Security
- Power Line >13.2 kV
- Power Line <13.2 kV
- Retaining Wall
- Road, Paved
- Road, Dirt
- Road/Trail
- Sewer Line
- Storm Drain/Culvert
- Telephone Line
- Water Line
- Permanent Structure
- Temporary Structure

3867-C

MAP 3:
Contour Map Showing Hazardous Waste Unit at Technical Area (TA) 15

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 500
Feet per inch on map = 100

SCALE 1:1200

0 30 60 90 120
METERS

0 100 200 300 400
FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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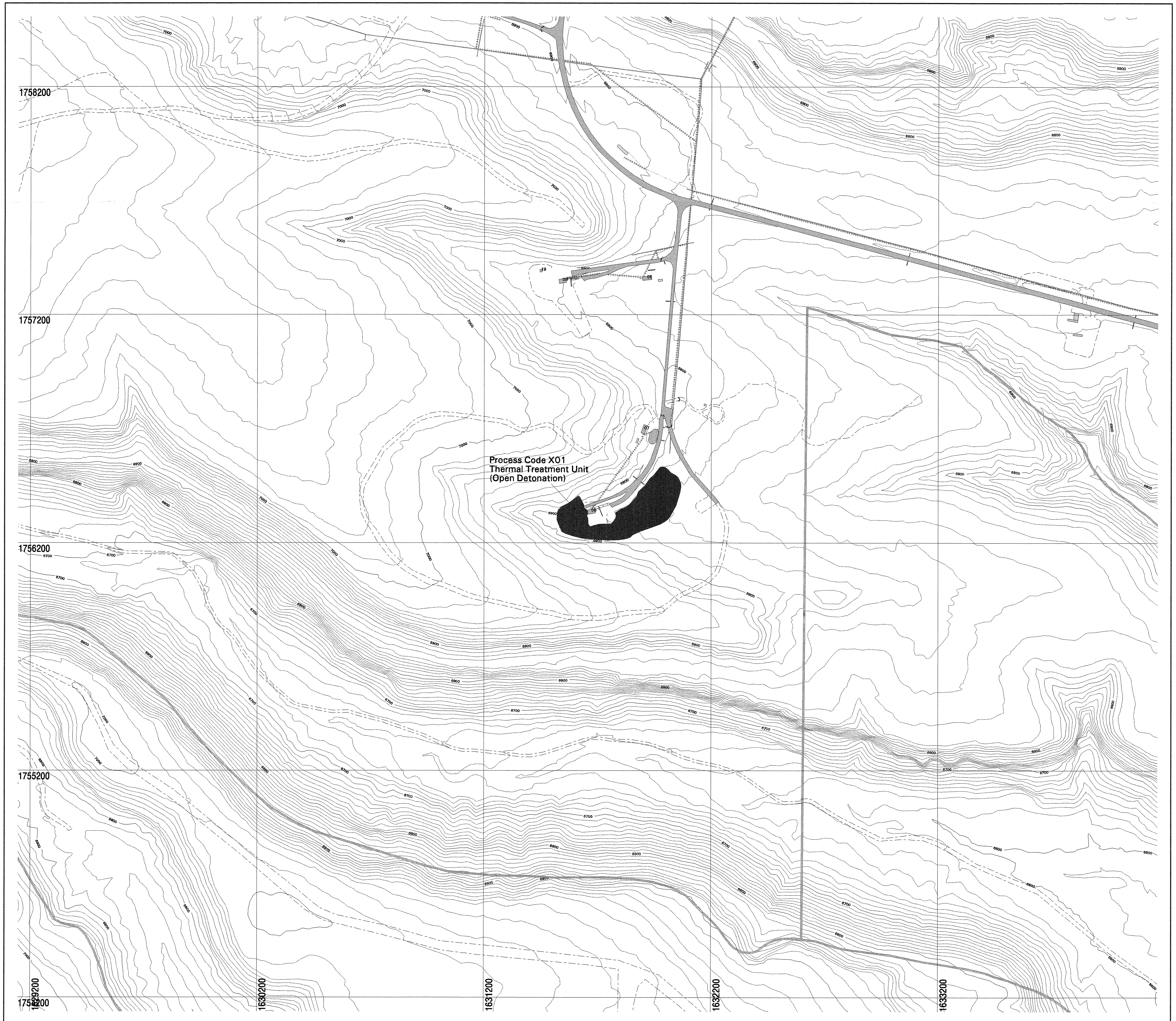
Produced by: Marcia Jones
Date: September 23, 1997 FIMAD Plot ID: G105878



LEGEND

- Boundary, TA
- Contour, 10 foot
- Contour, 100 foot
- Fence, Industrial
- Fence, Security
- Power Line >13.2 kV
- Power Line <13.2 kV
- Retaining Wall
- Road, Paved
- Road, Dirt
- Road/Trail
- Storm Drain/Culvert
- Telephone Line
- Permanent Structure
- Temporary Structure

3867-D

MAP 4:
Contour Map Showing Hazardous Waste Unit at Technical Area (TA) 36

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 1000
Feet per inch on map = 200

SCALE 1:2400

0 61 122 183 244
METERS
0 200 400 600 800
FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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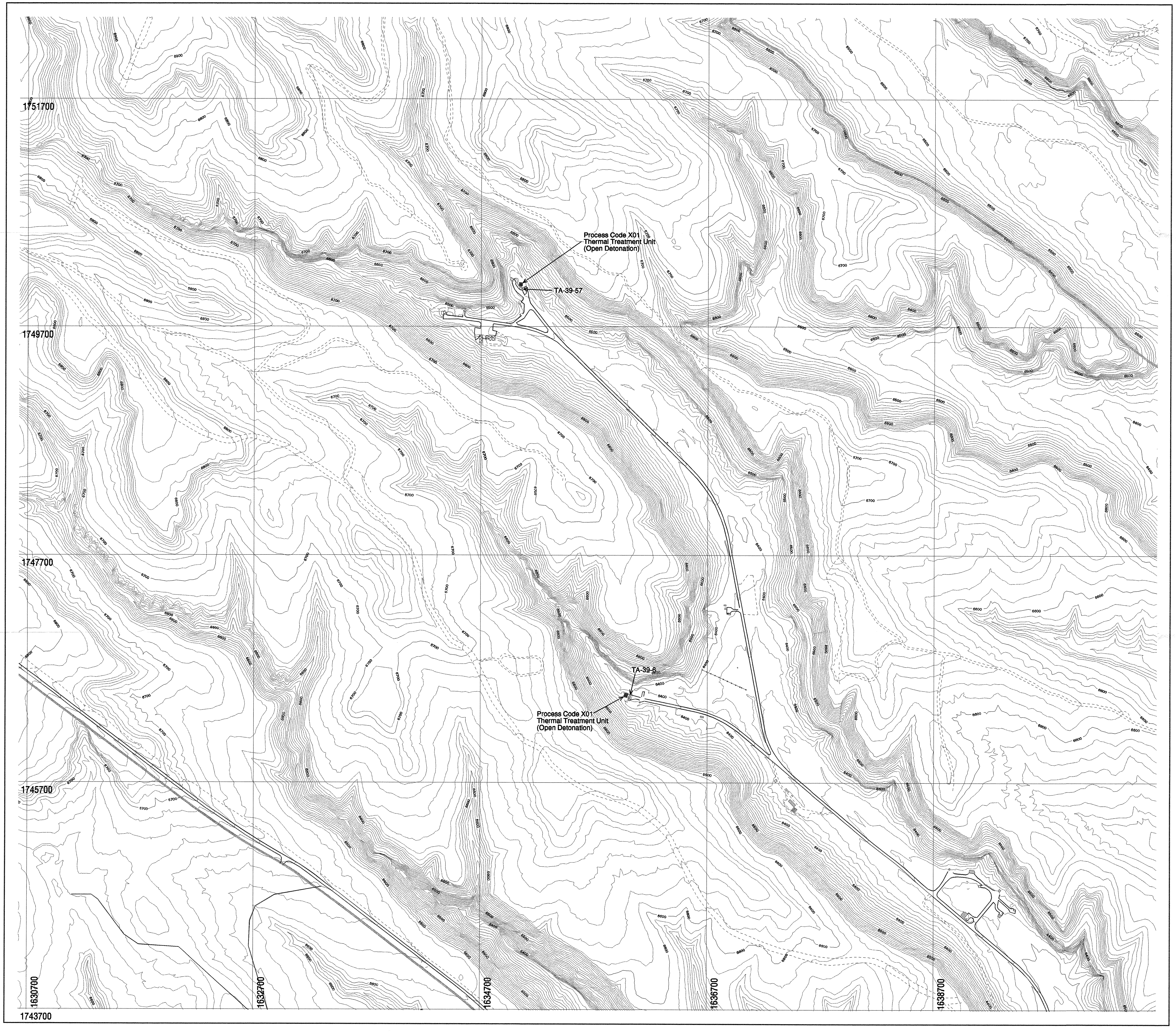
Produced by: Marcia Jones
Date: September 23, 1997 FIMAD Plot ID: G105879



LEGEND

- Boundary, Los Alamos National Laboratory
- Boundary, TA
- Contour, 10 foot
- Contour, 100 foot
- Fence, Industrial
- Fence, Security
- Road, Paved
- Road, Dirt
- Road/Trail
- Permanent Structure
- Temporary Structure
- Underground Structure

3867-E

MAP 5:
Contour Map Showing Hazardous Waste Units at Technical Area (TA) 39

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 2000
Feet per inch on map = 400

SCALE 1:4800

0 122 244 366 488
METERS

0 400 800 1200 1600
FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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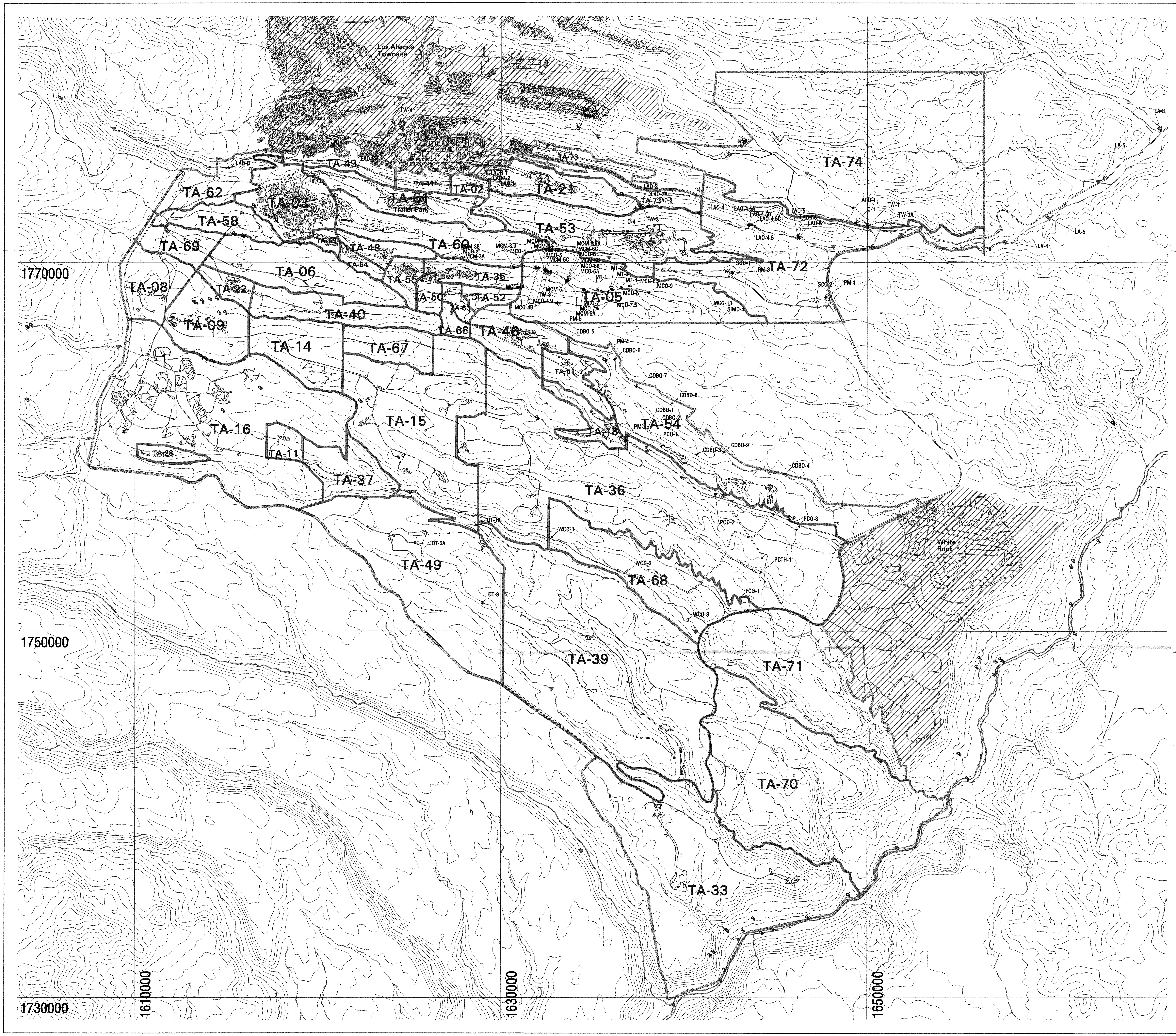
Produced by: Marcia Jones
Date: September 19, 1996 FIMAD Plot ID: G105138



LEGEND

Boundary, Los Alamos National Laboratory
Boundary, Technical Area (TA)
Contours, 100 foot
Roads, Dirt
Roads, Paved
Road/Trail
Stream, Intermittent
Stream, Perennial
Building
Residential Areas

PERCHED ALLUVIAL MONITORING WELLS
(Old wells are pre-1990, new wells installed since 1990 according to EPA guidelines)
New Dry Well
Old Dry Well
New Saturated Well
Old Saturated Well

MAIN AQUIFER WELLS
Water Supply Well
Test Well

OTHER
LAOR Well
Abandoned/Plugged Well

Surface Water Sampling Station
Spring

3867-F

MAP 6:
Location Map of Water Supply Wells, Monitoring Wells, Test Wells, Springs, and Surface Water Sampling Stations

N

State Plane Coordinate System, New Mexico Central Zone. 1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 20000
Feet per inch on map = 2500

SCALE 1:30000

METERS

FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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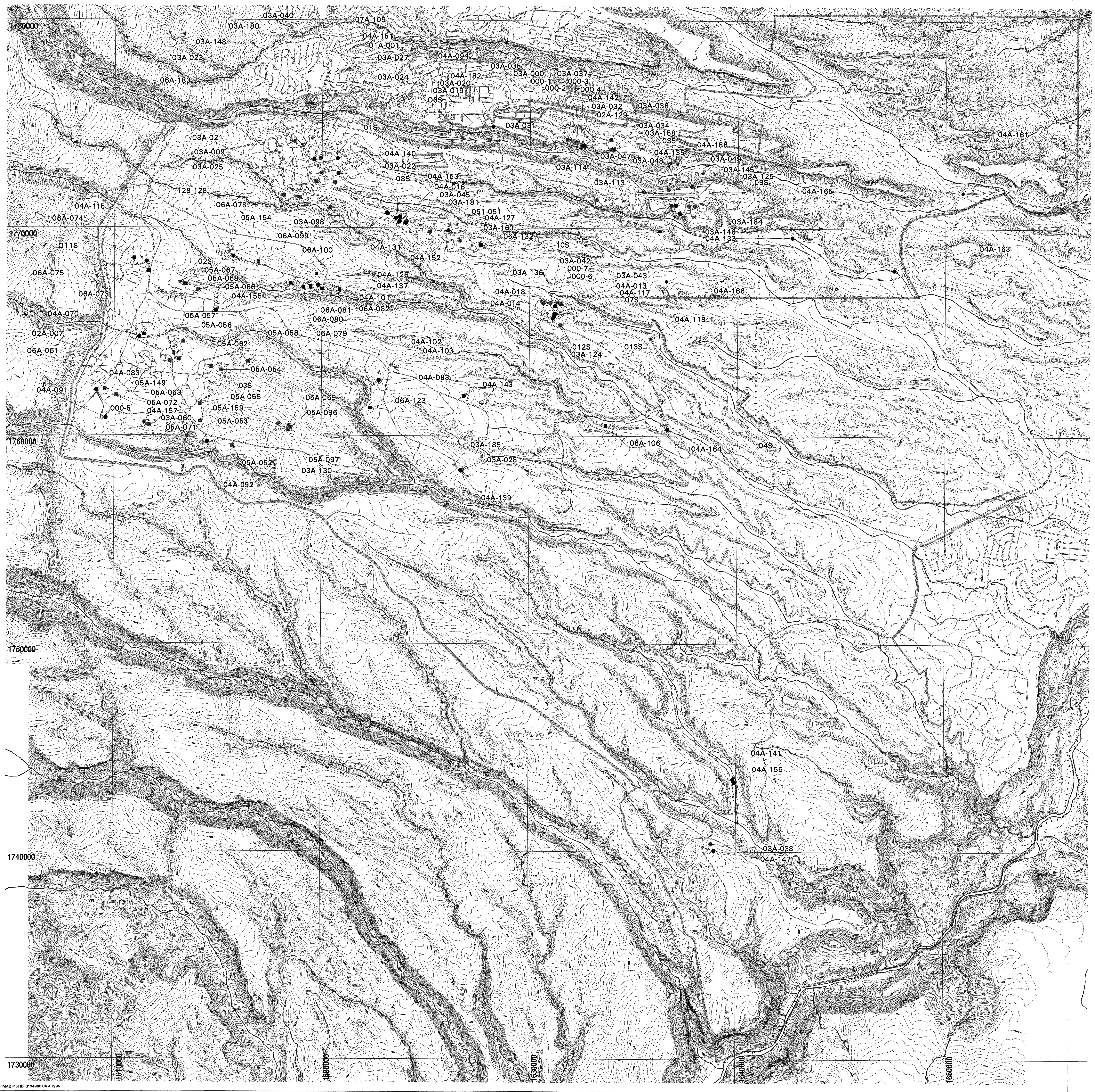
Produced by: Marcia Jones
Date: August 04, 1996 FIMAD Plot ID: G104979

NPDES OUTFALL LOCATIONS



NPDES Outfall Locations

LEGEND

- County Boundary
- Drainage
- LANL Boundary
- Roads, Paved
- 100-ft Contours
- 20-ft Contours

OUTFALL CATEGORIES

- 01A
- 02A
- 03A
- 04A
- 05A
- 06A
- Miscellaneous

3867-G

MAP 7:
Los Alamos National Laboratory (LANL) National Pollutant Discharge Elimination System (NPDES) Outfall Locations

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 10000
Feet per inch on map = 1750

SCALE 1:21000

0 533 1066 1599 2132
METERS

0 1750 3500 5250 7000
FEET

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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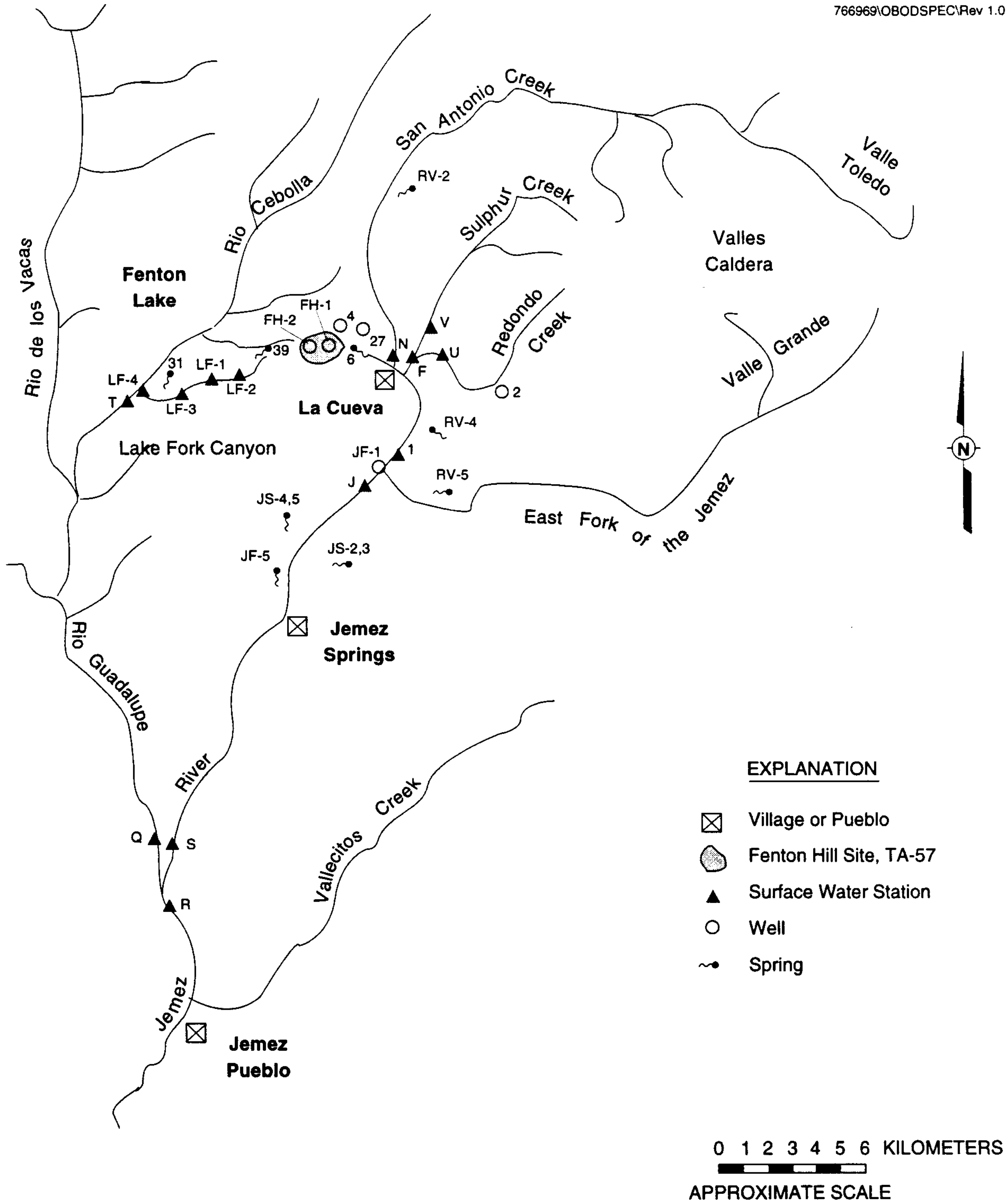
Produced by: Marcia Jones

Date: August 04, 1996 FIMAD Plot ID: G104980

FIMAD Plot ID: G104980 04 Aug 96



Reference: Los Alamos National Laboratory, 1994, "Environmental Surveillance at Los Alamos During 1992," LA-12764-ENV, Los Alamos National Laboratory, Los Alamos, New Mexico.

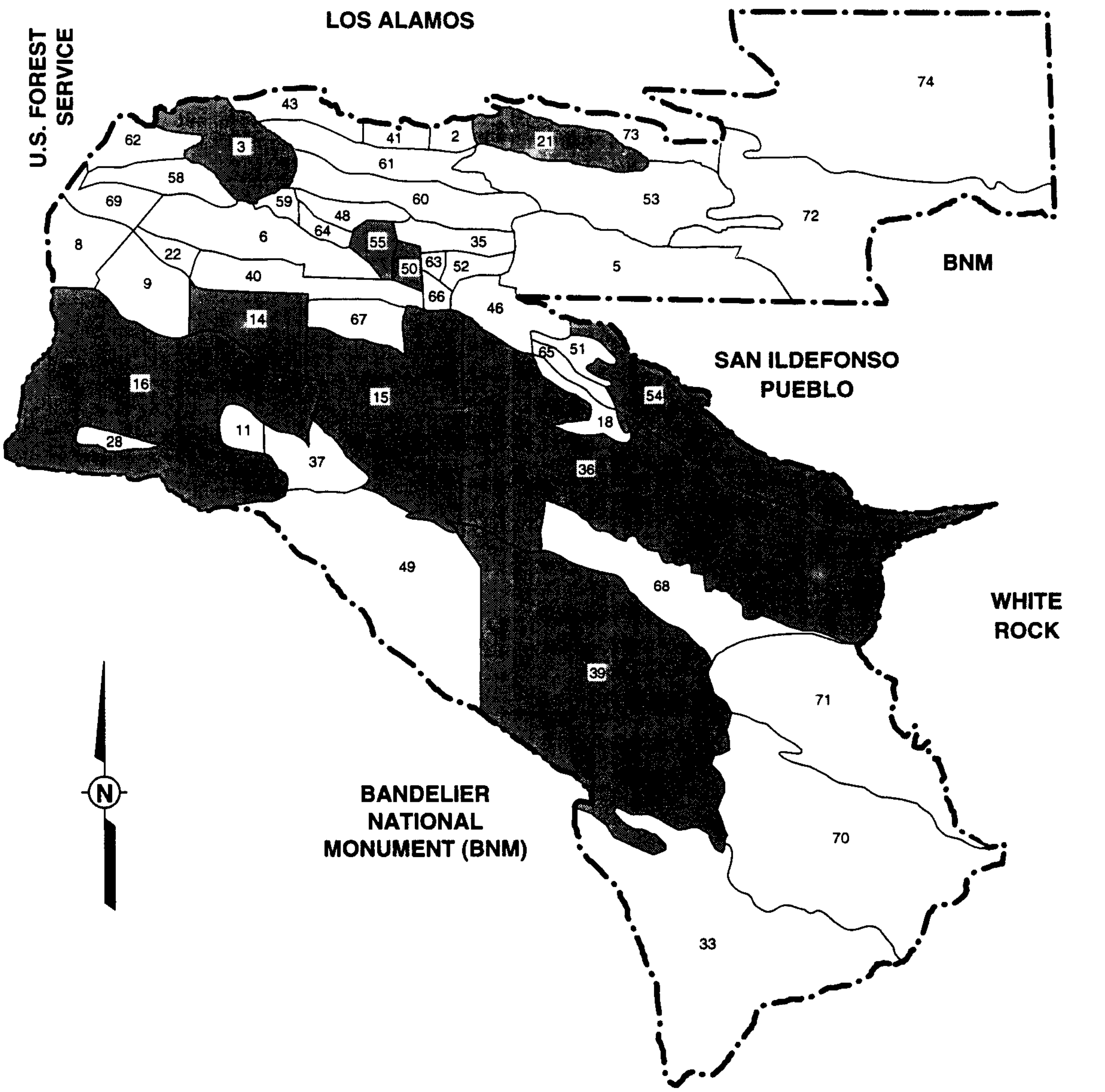
Map 8

Location Map of Technical Area (TA) 57, Fenton Hill Geothermal Site

ATTACHMENT 3

FACILITY DRAWINGS

LIST OF FACILITY DRAWINGS



Shading indicates technical areas in which hazardous or mixed waste units are located or planned for construction.

4800 0 4800 FEET
APPROXIMATE SCALE

Modified from: Los Alamos National Laboratory, 1994, "Environmental Surveillance at Los Alamos During 1992," LA-12764-ENV, Los Alamos National Laboratory, Los Alamos, New Mexico.

Figure 1
Location Map of Los Alamos National Laboratory Technical Areas

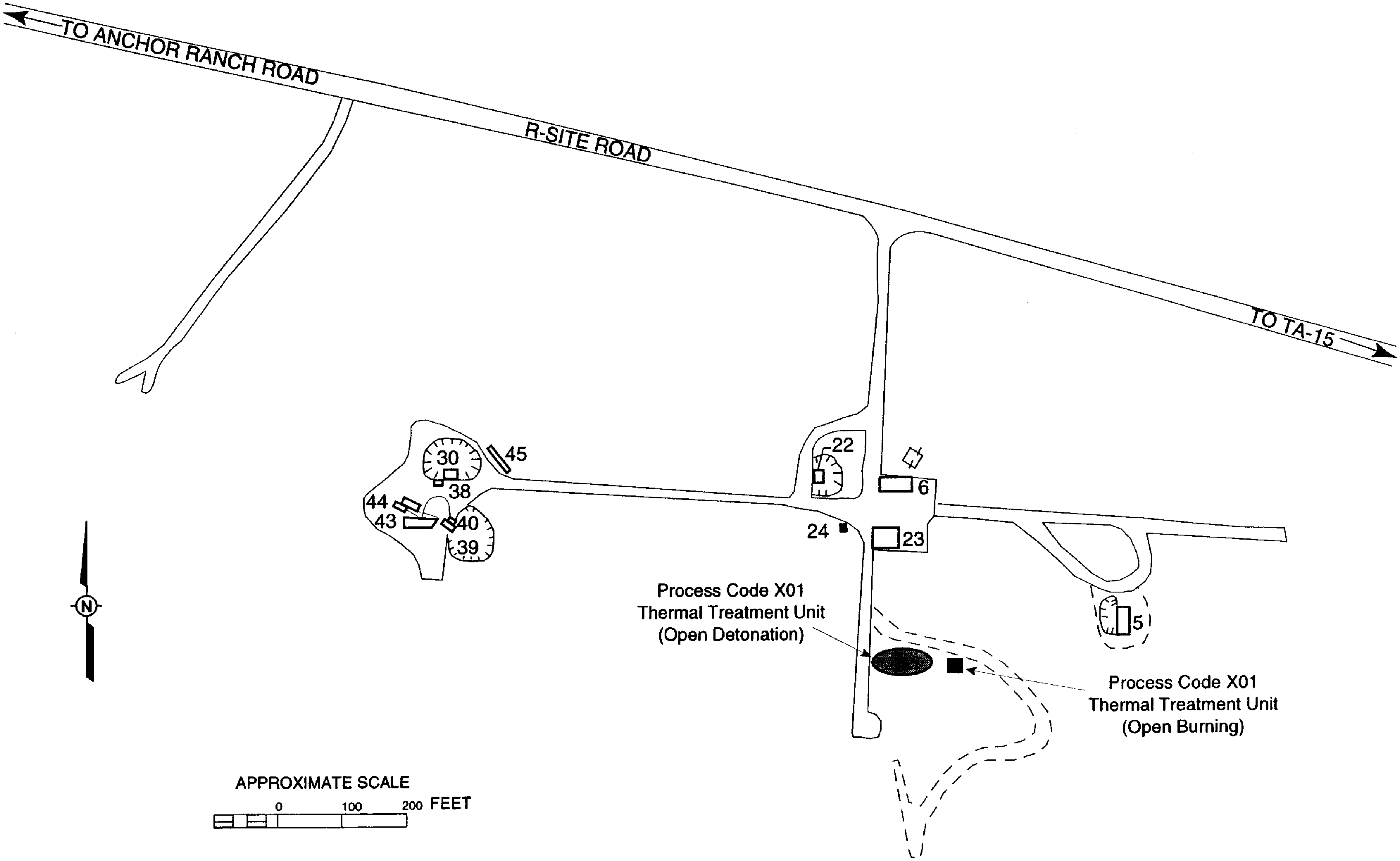


Figure 2
Location Map Showing the Thermal Treatment Units near Technical Area (TA) 14, Building 23

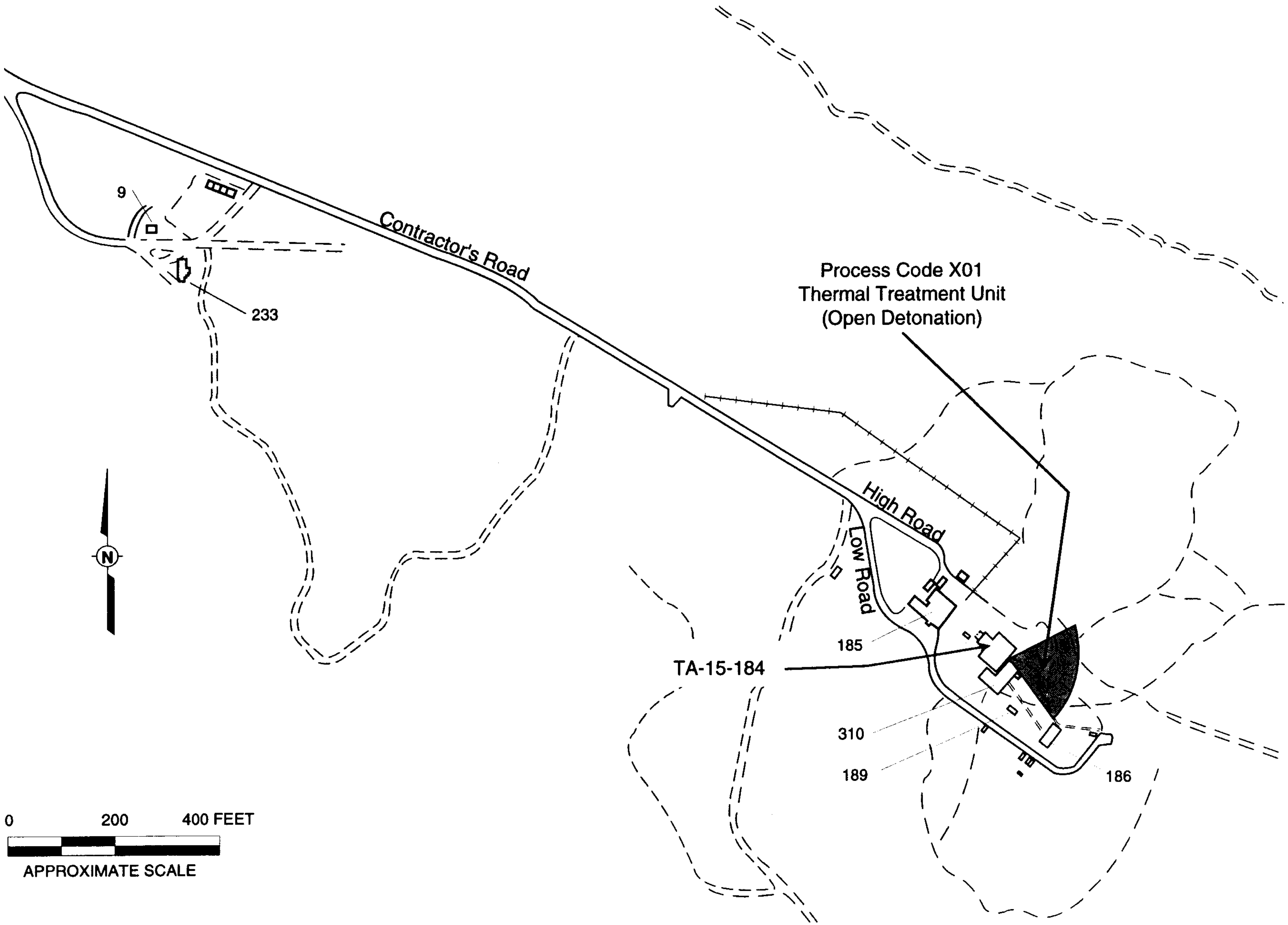


Figure 3
Location Map Showing the Thermal Treatment Unit near Technical Area (TA) 15, Building 184

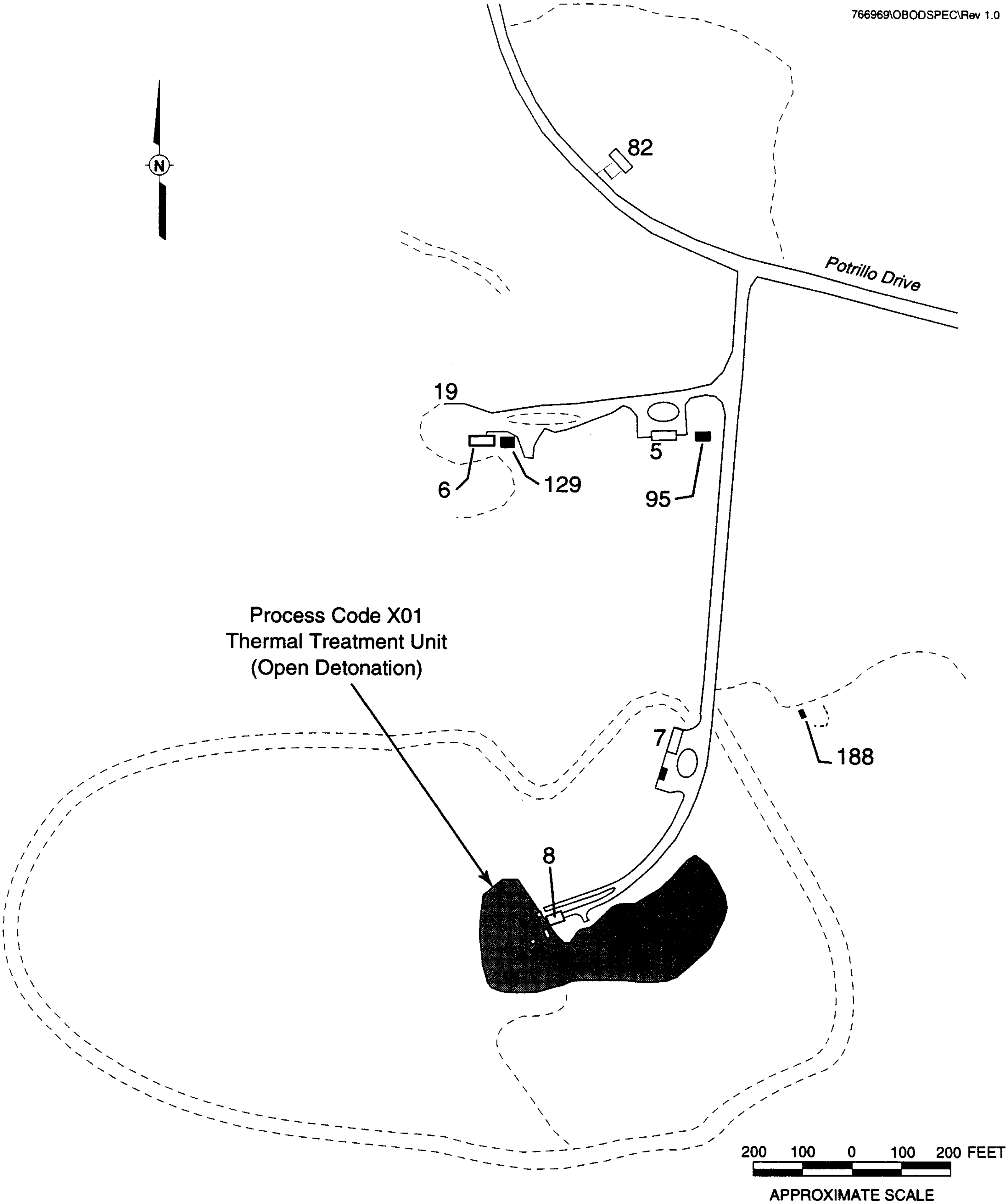


Figure 4
Location Map Showing the Thermal Treatment Unit near Technical Area 36, Building 8

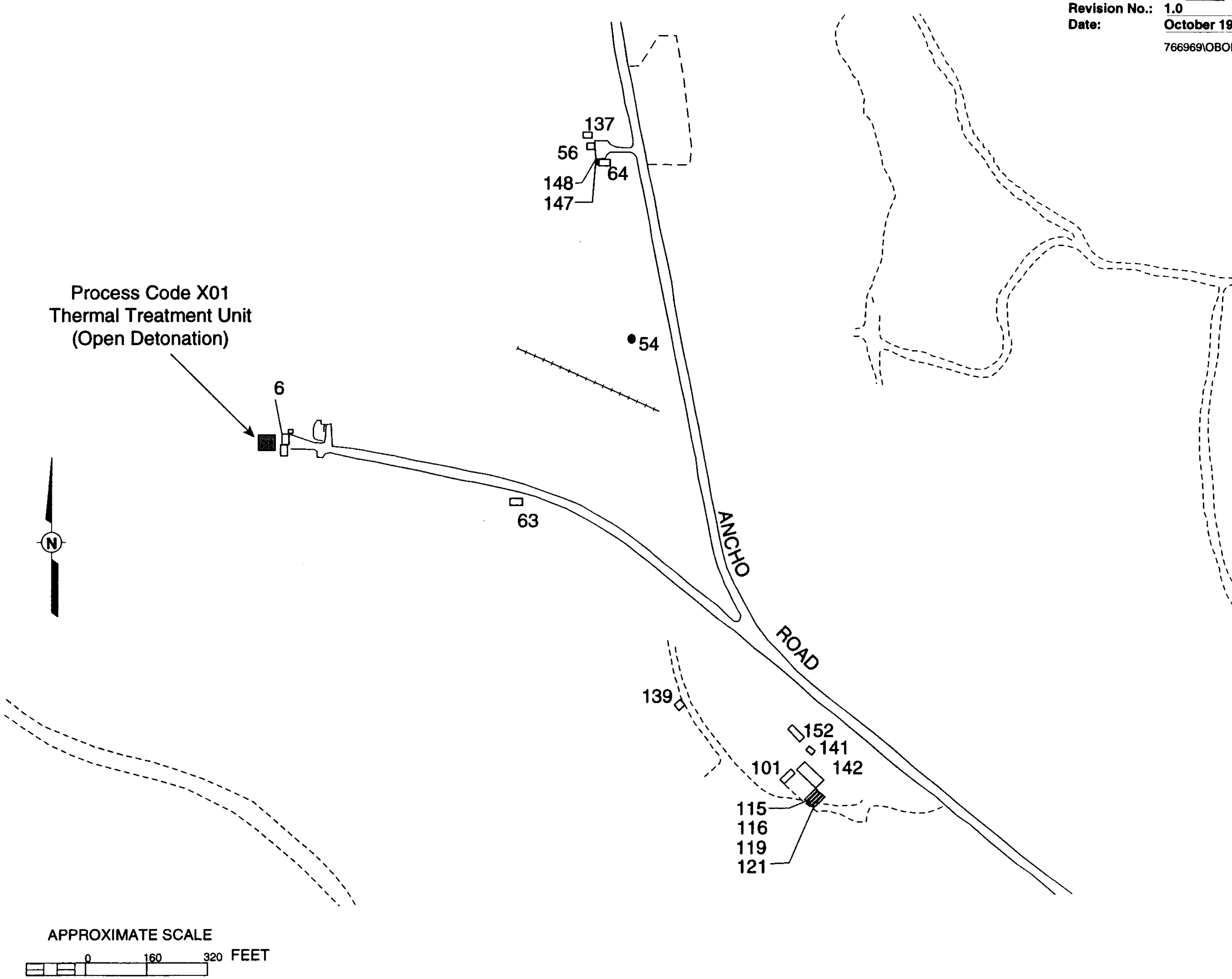


Figure 5
Location Map Showing the Thermal Treatment Unit near Technical Area 39, Building 6

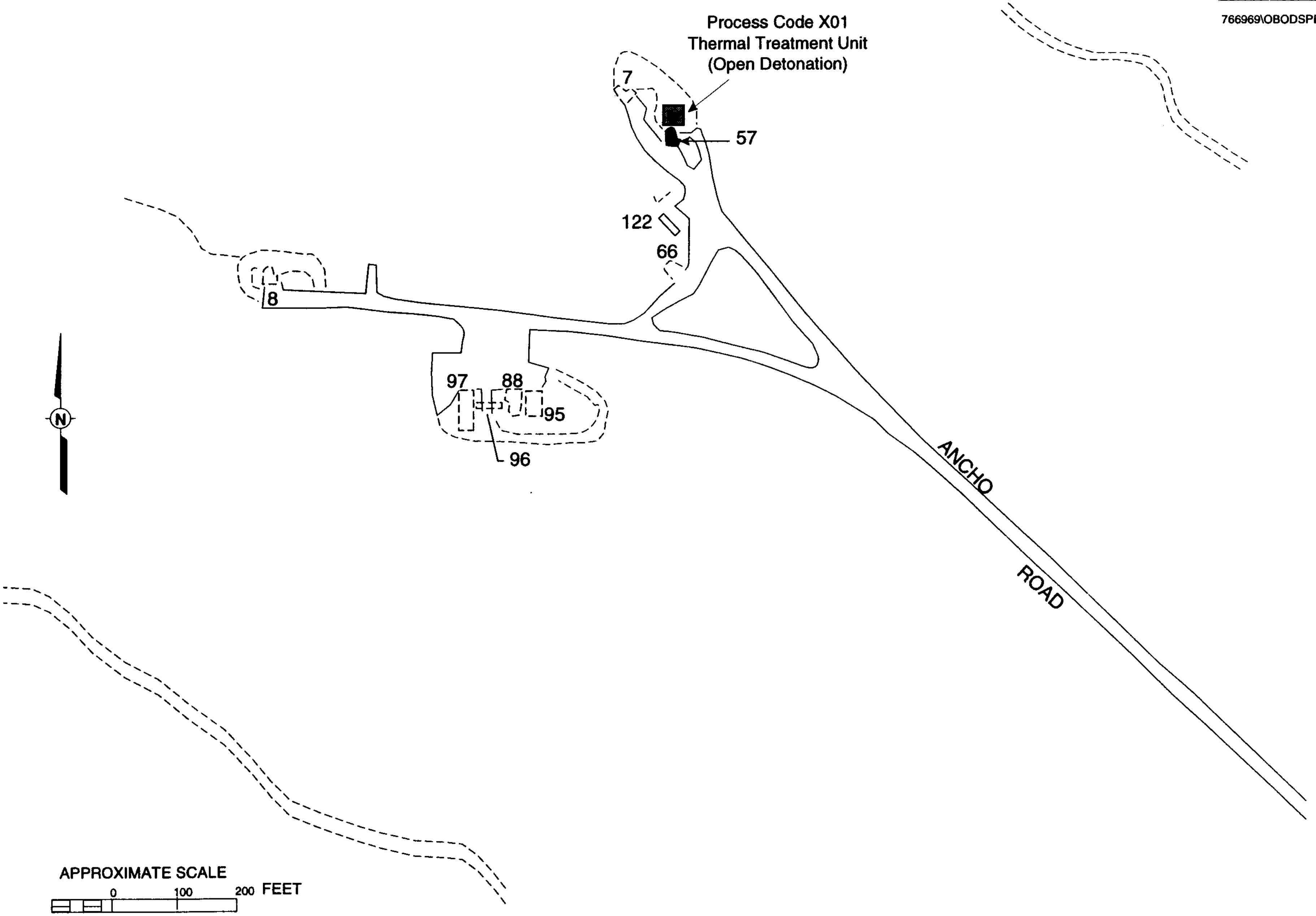
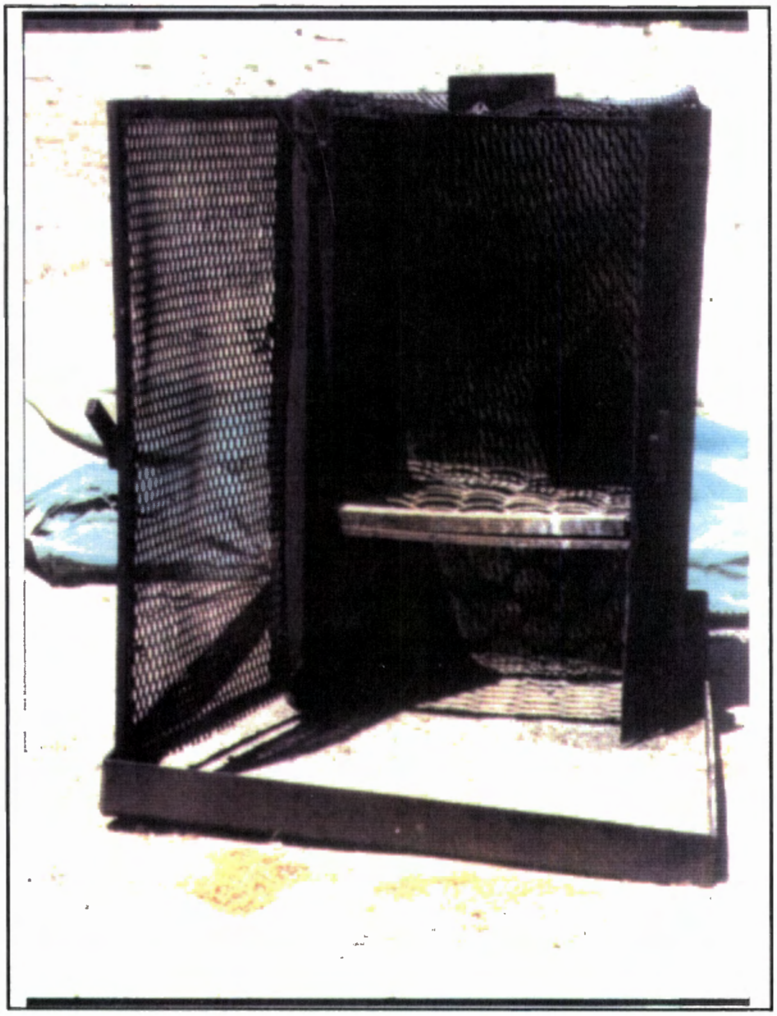


Figure 6
Location Map Showing the Thermal Treatment Unit near Technical Area 39, Building 57

ATTACHMENT 4

PHOTOGRAPHS

LIST OF PHOTOGRAPHS



TA-14-23, Process Code X01, Thermal Treatment Unit
(open burning)

TA-14-23, Process Code X01, Thermal Treatment Unit
(open detonation)

TA-15-184, Process Code X01, Thermal Treatment Unit
(open detonation)

TA-15-184, Process Code X01, Thermal Treatment Unit
(open detonation)
(View is looking southeast away from TA-15-184)

TA-36-8, Process Code X01, Thermal Treatment Unit
(open detonation)
(View is looking northeast toward TA-36-8)

TA-36-8, Process Code X01, Thermal Treatment Unit
(open detonation)
(View is looking west to bunker)

TA-39-6, Process Code X01, Thermal Treatment Unit
(open detonation)

TA-39-57, Process Code X01, Thermal Treatment Unit
(open detonation)

TA 14

Contract 9-XV2-139EE-1
Work Release 96-0016 (766969)
Revision 1.0
October 1997

Part B Permit Application
Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39

Volume I

Prepared by:

Los Alamos National Laboratory
Hazardous and Solid Waste Group (ESH-19)
Los Alamos, New Mexico 87545

Document:	LANL OB/OD Part B
Revision No.:	1.0
Date:	October 1997

Part B Permit Application
Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39

Volume I

Prepared by:
Los Alamos National Laboratory
Hazardous and Solid Waste Group (ESH-19)
Los Alamos, New Mexico 87545

ATTACHMENT A

NOTICE OF DEFICIENCY:

TECHNICAL ADEQUACY REVIEW OF PART B PERMIT APPLICATION SUBMITTED TO HRMB BY LOS ALAMOS NATIONAL LABORATORY (LANL), NEW MEXICO.

JUNE 10, 1997

A. ***General Description of the Facility*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(1). LANL (The Permit Applicant) must:*

1. *Provide general dimensions and a structural description of the Open Burning/Open Detonation* ***(OB/OD)*** *treatment units located at Technical Area 14* ***(TA-14)****. (This may include an active trench with adjacent buried trenches, a single active trench that is groomed and reused, an open burn containment device, and secondary containment or other design configurations.);*

   Response: See Section 4.1 of the "Part B Permit Application, Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39," Revision 1.0 (hereinafter referred to as the revised OB/OD Part B).

2. *Submit to the New Mexico Environment Department* ***(NMED)*** *Hazardous and Radioactive Materials Bureau* ***(HRMB)****, engineering drawings that approximate the units' dimensions horizontally and vertically, shows ramps, berms, fencing and any other man-made features used in association with the OB/OD units;*

   Response: See Section 4.1 of the revised OB/OD Part B.

3. *Provide the best available description of all wastes that have ever been managed or treated at the OB and OD units. Include a summary of historical information on the volume and composition of these wastes;*

   Response: See Section 4.1 of the revised OB/OD Part B.

B. ***Topographic Map*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(19). Since the map of TA-14 that HRMB received from LANL was compiled on a scale other than 1 inch to 200, LANL must submit to HRMB, a topographic which:*

1. *Shows the terrain for a distance of 1,000 feet (radius) outside the Open Burning/Open Detonation units, at a map scale of 1 inch equal to not more than 200 feet, with appropriate contour lines shown on the map;*

   Response: The note at the end of the requirements of 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(19) states that "For large HWM facilities the Agency will allow the use of other scales on a case-by-case basis." LANL has routinely provided topographic maps at various scales due to the areal extent of the facility. As was stated in Sections 2.1 and 2.1.1 of the OB/OD Part B (Revision 0.0), the OB/OD units at TA-14 are shown on Map 2 of the OB/OD Part A permit application (Revision 0.0). This topographic map shows the terrain for a distance exceeding 1,000 feet beyond the units, is at a scale of 1 inch equals 250 feet, and has contour lines to clearly show the pattern of surface water flow in the vicinity of and from each unit.

2. *Contains a wind rose diagram showing prevailing wind directions and velocities;*

Response: As stated in the introduction to Section 2.0 of the OB/OD Part B (Revision 0.0), a LANL-wide facility description addressing additional regulatory requirements is provided in Section 2.0 of the "General Part B Permit Application Information for Los Alamos National Laboratory" (the General Part B), submitted to NMED in August 1996. The General Part B was developed to consolidate general, LANL-wide facility information, applicable to all of LANL's current and future hazardous waste management units, into a single document for submittal to NMED to eliminate repetitive information. NMED verbally approved the General Part B strategy in December 1996. LANL provided a copy of the General Part B with the response package for the NOD.

Wind roses were discussed in Section 2.1.4 and were shown on Figures 2-3 and 2-4 of the General Part B. As presented therein, average wind directions at LANL are measured at four sites. TA-6, located approximately 1 mile north of TA-14, is the site closest to TA-14; therefore, its wind rose data are most applicable.

3. *Shows the legal boundaries of the OB/OD units. (The map should also have a title);*

Response: The boundaries of the OB/OD units were shown on Map 2 [titled "Contour Map Showing Hazardous Waste Units at Technical Area (TA) 14"] of the OB/OD Part A, Revision 0.0. The legal boundary of LANL, the HWM facility, was shown on Map 1 [titled "Contour Map Showing All Technical Areas (TA) at Los Alamos National Laboratory (LANL)"] of the OB/OD Part A, Revision 0.0.

4. *Contains access control to the OB/OD treatment units; and*

Response: Access control to the OB/OD treatment units was shown on Map 2 of the OB/OD Part A, Revision 0.0. An industrial fence surrounds the entire area (see map legend), a gate is located at the roadway entrance to the area (see map), and a second gate is located adjacent to TA-14-23 (see map). The gates are locked when operations are not being conducted at TA-14. The fence and site entry gate were also shown on Figure 5-1 of the OB/OD Part B. A revised Map 2 is provided in the revised OB/OD Part A to clarify the map symbols used.

Access is controlled administratively through implementation of SOPs (e.g., DX-4:SOP 1.0, DX-4:SOP 3, DX-4:SOP 4, and DX-4:SOP 27). Copies of these SOPs are included in Appendix B of the revised OB/OD Part B.

5. *Shows the SWMUs, on-site or off-site wells, buildings, and drainage and flood control barriers at, and in the vicinity of TA-14.*

   Response: The locations of SWMUs in the vicinity of the OB/OD units at TA-14 were shown on Figure 10-1 of the OB/OD Part B, Revision 0.0. All existing water supply wells, monitoring wells, test wells, springs, and surface water sampling stations within the LANL boundary (i.e., on-site) and surrounding LANL (i.e., off-site) were shown on Map 6 of the OB/OD Part A, Revision 0.0. Buildings in the vicinity of the OB/OD units were shown on Map 2 of the OB/OD Part A, Revision 0.0, and buildings at the LANL facility were shown on Map 1 of the OB/OD Part A, Revision 0.0. The locations of a proposed berm downslope of the OB/OD units and of the existing natural drainage upslope of and the road adjacent to the units to provide drainage control are shown on Map 2 of the revised OB/OD Part A.

C. ***Description of the OB/OD Treatment Units** as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.23. The Permit Applicant must:*

1. *Provide detailed plans and engineering drawings of the OB container device in addition to the description that was provided in the Permit Application of September 1996. Include a description of the lining material within and below the OB container device, and the secondary containment that will be located around it.*

   Response: See Section 4.1 and Appendix A of the revised OB/OD Part B.

2. *Describe how the OB/OD treatment units will be designed, constructed, operated and maintained to minimize run-off of hazardous constituents during the active life of the units, in compliance with 20 NMAC 4.1.500 incorporating 40 CFR §264.273(b).*

   Response: See Section 4.1 of the revised OB/OD Part B.

3. *Explain how a run-on control system will be designed, constructed, operated, and maintained to prevent flow onto the OB/OD units during peak discharge from at least a 24-hour, 25-year storm, as required by 20 NMAC 4.1.500 incorporating 40 CFR §264.273(c). Include a description of how ditches, berms or other diversion structures may need to be designed and constructed to prevent vertical and horizontal migration of waste constituents into the environmental media at and around TA-14.*

   Response: See Section 4.1 of the revised OB/OD Part B.

4. *Explain how the OB/OD units will be managed to control the releases of propellants, explosives, pyrotechnics as well as wind dispersal of ash and particulate matter to the environment, in order to meet standards required by 20 NMAC 4.1.500 incorporating 40 CFR §264.601(a) and 20 NMAC 4.1.900 incorporating §270.23(c).*

   Response: See Section 4.5 of the revised OB/OD Part B.

5. *Provide a description of methods to control the deterioration of the open burning devices, and the installation of a cover to prevent the accumulation of precipitation in*

the OB device during periods of inactivity. Explain how accumulation of precipitation in the OB container device will be handled.

Response: See Section 4.5 of the revised OB/OD Part B.

D. ***Contingency Plan*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(7) and 20 NMAC 4.1.500 incorporating 40 CFR §264.53. The Permit Applicant must submit information that:*

1. Identifies where copies of the Contingency Plan will be located; and

Response: As stated in Section 7.1 of the General Part B, a current copy of the contingency plan will be retained by the appropriate facility operators. A copy of the General Part B contingency plan and the OB/OD Part B contingency plan will be located at TA-14-23, Room 101. In addition, copies will be maintained at DOE/LAAO, ESH-19, and the DX Facility Management Office.

2. Describes a schedule of remedial action.

Response: See Section 7.3 of the revised OB/OD Part B.

E. ***Traffic Patterns*** *in accordance with 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(10). Submit to HRMB additional information as follows:*

1. Provide an estimate of the number and types of vehicles at and around the TA-14 OB/OD units;

Response: See Section 2.4.3 of the revised OB/OD Part B.

2. Provide information about hazardous waste transfer or pick-up stations and the loading/unloading procedures;

Response: See Section 4.5 of the revised OB/OD Part B.

3. Include a description of the quantity of waste moved per movement per vehicle; and

Response: See Section 4.5 of the revised OB/OD Part B.

4. Present a description of the route surface composition and load bearing capacity.

Response: See Section 2.4.3 of the revised OB/OD Part B.

F. ***Soil and Vadose Zone Monitoring*** *in accordance with 20 NMAC 4.1.500 incorporating 40 CFR §264.278; §264.601(b) and §264.13(b).*

Provide the following additional information on soil and vadose zone monitoring program:

1. *Describe sample collection, sample preservation, shipment, sampling and analysis procedures, and chain of custody control;*

   Response: See the revised OB/OD Part B Sections 4.6.3.2 (for soil monitoring) and 4.6.1 (for vadose zone monitoring).

2. *Indicate the parameters selected and the EPA approved or equivalent acceptable analytical method for each parameter;*

   Response: See Section 4.6.3.2 and Table 4-1 of the revised OB/OD Part B.

3. *List background values for each proposed monitoring parameter or hazardous constituent;*

   Response: See Section 4.6.3.2 and Table 4-2 of the revised OB/OD Part B.

4. *Give details of the proposed sampling, analysis and statistical comparison procedures for the soil sample analytical results;*

   Response: See Section 4.6.3.2 of the revised OB/OD Part B.

5. *Specify the sampling method which will be used to obtain a representative sample of the contaminated soil to be analyzed. [A representative soil sample may be obtained using either one of the sampling methods found in Appendix I of 20 NMAC 4.1.200 incorporating 40 CFR §261 or an equivalent acceptable method];*

   Response: See Section 4.6.3.2 of the revised OB/OD Part B.

6. *Provide details of the sampling and analysis plan for monitoring the vadose zone during treatment operations and for the potential of waste constituents to migrate into the ground water as required by 20 NMAC 4.1.500 incorporating 40 CFR §264.273;*

   Response: See Section 4.6.1.2 of the revised OB/OD Part B.

7. *Describe how "kick-out" residues and unexploded ordnance will be managed. Some types of reactive waste will not detonate but rather deflagrate. Results of detonation of these types of wastes can cause dispersions of untreated explosives into the environment. Explain how this has been considered in the management of the reactive wastes at TA-14 OB/OD sites;*

   Response: See Section 4.5 of the revised OB/OD Part B.

8. *Describe how background soil samples will be taken, the appropriate locations of the background samples, and depths from which the samples will be obtained; and*

   Response: See Section 4.6.3.2 of the revised OB/OD Part B.

9. *Explain how the results of soil and soil pore liquid monitoring will be expressed for the determination of statistically significant changes over background values for Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Beryllium, Silver and Antimony. [20 NMAC 4.1.500 incorporating 40 CFR §264.278(f)].*

   Response: LANL proposes to analyze only for the metals that may be in the waste stream (barium) and in the detonator caps (chromium). Arsenic, cadmium, lead, mercury, selenium, beryllium, silver, and antimony are not constituents in the waste stream; therefore, samples will not be analyzed for these metals. The method to be used for determination of statistically significant changes over background values is described in Section 4.6.3.2 of the revised OB/OD Part B.

G. ***Waste Analysis Plan** as required by 20 NMAC 4.1.500 incorporating 40 CFR §264.13(b) and 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b)(3).*

1. *Land Disposal Restrictions as required by 20 NMAC 4.1.800 incorporating 40 CFR §268.30 and §268.35.*

   a. *Explain the chemical composition, and the nature of F005 wastes listed in the Part A Permit Application on Page 6 of 7. Are these spent solvent wastes, solvent wastes contaminated with soil and debris, 2-ethoxy ethanol, 2-nitropropane, or benzene?*

      Response: See Section 3.1 of the revised OB/OD Part B.

   b. *What is the characteristic toxicity of the Barium-bearing D005 waste based upon? Also, explain why LANL plans to detonate these D005, and F005 wastes contrary to the Land Disposal Restrictions that apply to them.*

      Response: See Sections 3.1 and 3.5.1 of the revised OB/OD Part B.

2. *Submit separate lists of all the waste propellants, explosives, and pyrotechnics that will be treated at the OB and the OD units by re-categorizing the list of waste munitions that were provided in Attachment 3 of the September 1996 Part B Permit Application.*

   Response: See Section 3.3 of the revised OB/OD Part B.

3. *Present a detailed Quality Assurance/Quality Control Program **(QA/QC)**, or QA/QC Management Plan that will be applied during soil sampling and analysis to ensure that representative discrete soil samples are taken.*

   Response: See Sections 3.3.2 and 4.6.3.2 of the revised OB/OD Part B.

4. *Describe how LANL plans to monitor non-reactive hazardous waste treated simultaneously with reactive waste at the OB and OD units. Such non-reactive wastes include lead projectiles of small arms munitions and hazardous constituents of containers, housings, and casings.*

Response: See Section 3.1 of the revised OB/OD Part B.

5. *Specify where copies of the Waste Analysis Plan **(WAP)** will be located at TA-14.*

   Response: Copies of the WAP from the OB/OD Part B and the General Part B will be located at TA-14-23, Room 101.

6. *Identify the designated personnel position(s) and organization responsible for updating the WAP.*

   Response: Personnel from LANL's Hazardous and Solid Waste Group (ESH-19) will be responsible for updating the WAP, when required.

7. *If post-detonation soil monitoring or ground water monitoring is chosen as the method of compliance with the Waste Analysis Plan, describe sampling methods that will be used to obtain discrete representative samples of the soil or water to be analyzed. List the parameters that will be analyzed for in each reactive and non-reactive hazardous waste, the rationale for the selection of these parameters, and the test methods which will be used for these parameters.*

   Response: Soil and groundwater monitoring are discussed in Sections 4.6.3 and 4.6.1, respectively. LANL proposes to conduct soil monitoring as a distinct activity separate from waste analysis.

8. *Submit to HRMB, the analytical results of soil samples taken from Building 35 located in TA-14. The "Results Summary of the Soil Sampling Survey" presented in Attachment 4-3 of the unit-specific Part B Permit Application is insufficient for NMED to interpret.*

   Response: See Section 4.6.3.1 and Appendix C of the revised OB/OD Part B.

H. ***Closure and Post-Closure Plans** in accordance with the requirements contained in 20 NMAC 4.1.500 incorporating 40 CFR §264.112 through §264.115, §264.117-118, and 20 NMAC 4.1.900 incorporating 40 CFR §270.14(b).*

   1. *Explain why closure activities are described for container storage areas, tanks, and surface impoundments on page 9-3, Section 9.1.3 of LANL's General Part B Permit Application. Since these units are not part of the OB/OD units LANL must:*

      a. *Provide specific information on the container storage areas and tanks, their locations, and the purpose for which they are used at TA-14.*

         Response: As explained in the response to Comment B.2, the General Part B was developed to consolidate general, LANL-wide information, applicable to all of LANL's current and future hazardous waste management units, into a single document to eliminate repetitive information. NMED verbally approved this strategy in December 1996. Certain sections of the General Part B (e.g., Section 9.1.3) include language that is broad or generalized in nature. It is indicated throughout the General Part B that units for which a permit is sought will be addressed in TA- or unit-specific Part B permit applications (e.g., the OB/OD Part B) to be submitted separately. LANL is not seeking permitted status for container storage areas, tanks, or surface impoundments at TA-14 because there are none of these unit types subject to RCRA regulation at TA-14. Permitted status is being sought for the OB/OD units located at TA-14 and described in the OB/OD Part B.

b. *Submit a separate Part B permit application for the surface impoundments, container storage units, and tanks mentioned on page 9-3 of the LANL General Part B Permit Application of August 1996.*

Response: See previous response.

2. *Provide information on the TA-14 OB/OD units which must include the following information:*

a. *Provide a description of the maximum extent of the unclosed portion of the OB/OD units during their permitted life;*

Response: See Section 9.2.1 of the revised OB/OD Part B.

b. *Submit an outline of the procedures for removal of hazardous waste, residues or post investigation derived waste, and contaminated soils as well as the location of disturbed soils when removed;*

Response: See Sections 9.1 and 9.3 of the revised OB/OD Part B.

c. *Provide the estimated year of closure of the OB/OD units;*

Response: See Section 9.1 of the revised OB/OD Part B.

d. *Submit a description of the location and number of copies of the Closure and Post-Closure Plans for OB/OD;*

Response: At a minimum, copies of the closure plan for the OB/OD units at TA-14 will be located at TA-14-23, Room 101. In addition, copies will be maintained at DOE/LAAO, ESH-19, and the DX Facility Management Office.

e. *Name the personnel responsible for storage, updating of facility copies of the Closure and Post-Closure Plans, and the procedure for updating all other copies of the subject plans.*

Response: As stated above, personnel at DOE/LAAO, ESH-19, the DX Facility Management Office, and TA-14 will be responsible for storing their respective copies of the closure plan. Personnel from ESH-19 at LANL will be primarily responsible for updating the plan. The names of these personnel are not provided here because they are subject to frequent change. Updated plans will be identified with the latest revision number throughout the document. See response to Comment H.2.g.

f. Explain the potential request for extension of closure time.

Response: LANL does not anticipate the need to request an extension of the time allowed for closure of these units. However, as was stated in Section 9.1.3 of the General Part B and as allowed by the regulations cited therein, LANL may request an extension if unforeseen events occur prior to or during closure activities and these events necessitate such a request.

g. Submit a detailed contingency Post-Closure Plan and Post-Closure Care mechanisms as per 20 NMAC 4.1.500 incorporating 40 CFR §264.603 in order to fulfill the requirements of 40 CFR §264.601. This required information was not included in the Subject Application.

Response: See Section 9.1 of the revised OB/OD Part B.

I. Protection of Ground Water

1. ***Hydrology*** *as required by 20 NMAC 4.1.900 incorporating 40 CFR §270.23(b). The Permit Applicant must provide a detailed description of the hydrology below the OB/OD units at TA-14. (This may be available through published or private reports. Include a copy or copies of the references used.)*

   Response: See Sections 4.6.1.1 and 4.6.1.2 of the revised OB/OD Part B.

2. *Provide site-specific data for initially characterizing the OB/OD units and the 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 data collection prior to initiating any data collection program.*

   Response: See Section 4.6.1.2 of the revised OB/OD Part B.

3. ***Prevention of Releases*** *- Explain what measures will be incorporated into the OB/OD treatment unit design to exclude water from entering the units. [Direct rainfall entering the open burn device and the open detonation pit (created by the blast) could cause a hydraulic head that would drive waste constituents into the vadose zone. Some facilities have used weather covers over their OD pits and burn container devices during periods of inactivity].*

   Response: See Section 4.1 of the revised OB/OD Part B.

4. *The location map of water supply wells* ***(Map Number 6 in Part A Permit Application)*** *that LANL submitted to HRMB does not show any ground water monitoring or test wells in the vicinity of TA-14. NMED acknowledges receipt of the December 6, 1996 Hydrogeologic Work Plan from LANL. HRMB will evaluate this section within the*

context of that Plan. However, LANL is required to present the following information to HRMB:

a. Submit a Ground Water Detection Monitoring Program in accordance with all the requirements contained in 20 NMAC 4.1.500 incorporating 40 CFR §264.98. The ground water monitoring wells must include one upgradient and at least two downgradient monitoring wells. Attach a topographic map that shows the location of background water quality monitoring wells at the site of the OB/OD treatment units.

Response: See Section 4.6.1.2 of the revised OB/OD Part B.

b. Provide a description of well design, sample collection, preservation, shipment, QA/QC procedures, sampling and analysis procedures, data evaluation and reporting that satisfy the requirements of 20 NMAC 4.1.500 incorporating 40 CFR §264.97. List the indicator parameters and hazardous waste constituents that will be analyzed for, and how monitoring well evacuation will be conducted at TA-14.

Response: See Section 4.6.1.2 of the revised OB/OD Part B.

5. *Provide a description of any plume of contamination that has entered the ground water due to previous OB/OD activities. Indicate on the topographic map the vertical and horizontal extent of the plume.*

Response: See Section 4.6.1.2 of the revised OB/OD Part B.

6. *Present a description of the proposed sampling and analysis and the statistical comparison procedures and data evaluation that will be applied to ground water samples in accordance with 20 NMAC 4.1.900 incorporating 40 CFR §270.14(c)(6)(iv).*

Response: See Section 4.6.1.2 of the revised OB/OD Part B.

7. *Provide an account of how background values for each proposed monitoring parameter or constituent will be determined to meet the requirements contained in 20 NMAC 4.1.900 incorporating 40 CFR §270.14(c)(6)(iii).*

Response: See Section 4.6.1.2 of the revised OB/OD Part B.

8. *Describe how LANL would determine the direction, ground water flow rate, and the rate of plume migration in case of ground water contamination. [20 NMAC 4.1.500 incorporating 40 CFR §264.601(a)(5)].*

Response: See Section 4.6.1.2 of the revised OB/OD Part B.

9. *Provide an account of the precipitation patterns at TA-14, proximity to and withdrawal rates of current and potential ground water users in accordance with the standards required by 20 NMAC 4.1.500 incorporating 40 CFR §264.601(b)(3) and 40 CFR §264.601(b)(5).*

Response: See Section 4.6.1.1 of the revised OB/OD Part B.

10. *Provide an account of water quality standards, water quality data and uses. These data will allow NMED to evaluate the impact of the activities at the OB/OD units on surface aquatic environment in compliance with the requirements of 20 NMAC 4.1.500 incorporating 40 CFR §264.601(b)(7), and 40 CFR §264.601(b)(8).*

    Response: See Section 4.6.2.2 of the revised OB/OD Part B.

J. ***Air Quality Assessments*** *as required in 20 NMAC 4.1.500 incorporating 40 CFR §264.601(c)(1) and 20 NMAC 4.1.900 incorporating 40 CFR §270.23(b).*

LANL must submit the following information to NMED:

1. *Provide a description of the operating conditions of the OB and OD units on a case-by-case basis. [Examples are: not to expose ash residues from the OB unit to the open air when wind speed is greater than 15 miles per hour (24 km/hr), allowable quantities of waste per unit, operating time frames, acceptable meteorological conditions, ambient air monitoring requirements, meteorological, monitoring etc.].*

    Response: See Section 4.6.4.3 of the revised OB/OD Part B.

2. *Submit a description of the effectiveness and reliability of any systems and structures used to reduce or prevent emissions of hazardous constituents to the air. This may be demonstrated by semi-annual sampling and analysis programs following the last semi-annual waste treatment event; [20 NMAC 4.1.500 incorporating 40 CFR §264.601(c)(2)].*

    Response: See Section 4.6.4.3 of the revised OB/OD Part B.

K. ***Risk Analysis***

Provide a Risk Analysis that includes the following issues:

1. *A description of the existing air quality, other sources of contamination and the potential cumulative impact on human health and the environment. Present an estimate of the individual excess lifetime cancer risk.*

    Response: At a meeting on August 12, 1997, NMED requested that the language in Comments K.1 and K.2 be modified and treated as one comment. See Section 4.12.1 and Appendix D in the revised OB/OD Part B.

2. *An outline of the potential for health risks caused by human exposure (including the explosive ordnance disposal personnel) to hazardous waste constituents;*

    Response: See response to Comment K.1.

3. *A discussion of potential damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to hazardous waste constituents from the OB/OD units. Discuss other exposure pathways such as: plant ingestion by herbivores, prey consumption by carnivores, and water ingestion pathways;*

   Response: At a meeting on August 12, 1997, NMED requested that the language in Comment K.3 be modified to read only "Evaluate the food web." See Section 4.12.1 and Appendix D of the revised OB/OD Part B.

4. *An account about the presence of the following endangered or threatened species at or around the TA-14 OB/OD treatment units:*

   a. *Bald Eagle (Haliaeetus leucocephalus alascanus);*
   b. *Jemez Mountains Salamander (Plethodon neomexicanus);*
   c. *American Peregrine Falcon (Falco peregrinus anatum);*
   d. *Whooping Crane (Grus americana);*
   e. *Broad-billed Hummingbird (Cynanthus latirostris magicus);*
   f. *Southwestern Willow Flycatcher [Empidonax ludovicianus (3ssp.)];*
   g. *Gray Vireo (Vireo vicinior); and*
   h. *Meadow Jumping Mouse (Zapus hudsonius luteus)*

   Response: At a meeting on August 12, 1997, NMED requested that the language in Comment K.4 be modified by deleting "An account about the presence of" and replacing this language with "In the evaluation, consider the potential exposure of". In addition, NMED requested that LANL add the Mexican Spotted Owl (*Strix occidentalis lucida*) as Item K.4.i. See Section 4.12.1 and Appendix D of the revised OB/OD Part B.

5. *A description of any sensitive receptors within a 2 kilometer radius, and an estimate of exposed individuals living and/or working on the OB/OD premises;*

   Response: At a meeting on August 12, 1997, NMED requested that the language in Comments K.5, K.6, and K.9 be modified to read only "Evaluate the potential residential and workers exposure scenarios. Consider all potentially affected media and relevant exposure pathways." See Section 4.12.1 and Appendix D of the revised OB/OD Part B.

6. *Calculations of the lifetime cancer risk as a function of downward concentrations, unit risk value, and exposure duration;*

   Response: See Section 4.12.1 and Appendix D of the revised OB/OD Part B.

7. *An explanation of how atmospheric air quality will be monitored to detect air borne hazardous waste contaminants and constituents during the active life of the OB/OD units. Section 4.6.4.2 of LANL's Part B Permit Application mentioned that efforts to detect "air borne contaminants at TA-14 have not yet been established", explain why.*

   Response: See Section 4.6.4.2 of the revised OB/OD Part B.

8. *Provide a detailed network of receptor points to permit the estimation and identification of receptor points that are exposed to maximum contaminant concentrations.*

   Response: See Section 4.12.1 and Appendix D of the revised OB/OD Part B.

9. *Provide a detailed estimation of the exposed population. The noninhalation pathways (ingestion and dermal) must be addressed using appropriate pathway exposure models. (The* U.S. Army Environmental Hygiene Agency Guide *may be used for reference].*

   Response: See Section 4.12.1 and Appendix D of the revised OB/OD Part B.

10. *If operating procedures will require wetting of the open burn area before and after each operation, describe how this will be accomplished and what measures will be taken to minimize release of hazardous waste to the environmental media.*

    Response: See Section 4.5 of the revised OB/OD Part B.

11. *Provide a brief historical description of TA-14 and the OB/OD areas, and the presence of any archeological sites.*

    Response: See Section 4.13.1 of the revised OB/OD Part B.

L. ***Potential Pathways of Exposure and Potential Exposure Magnitude** as required in 20 NMAC 4.1.900 incorporating 40 CFR 270.23(c). The Permit Applicant must describe the potential for the public to be exposed to hazardous wastes. Include*

   1. *Information on how long waste will remain in the unit before it is detonated, the length of time after operation of the unit before re-entry of personnel to the detonation site is allowed, and*

      Response: See Section 4.5 of the revised OB/OD Part B.

   2. *Procedures for management of ash residues, unexploded ordnance, and post-detonation soils.*

      Response: See Sections 4.5 and 4.6.3.2 of the revised OB/OD Part B.

M. ***Health and Safety Plan***

   Provide health and safety procedures during waste management operations in the form of a stand-alone health and safety plan for routine operations at the OB/OD units.

   Response: The health and safety procedures followed by site personnel during routine operations are discussed in the SOPs included in Appendix B of the revised OB/OD Part B.

N. ***Noise Considerations** and the distance of OB/OD units from off-plant inhabited buildings, and minimum safety distances to the property of others in compliance with 20 NMAC 4.1.600 incorporating 40 CFR §265.382.*

1. *Describe how noise from open detonation activities will be controlled, since noise will be carried in the direction of the wind towards the city of Los Alamos.*

   Response: See Section 4.14.1 of the revised OB/OD Part B.

2. *Describe a method for determination of ground vibration at the OD unit, and specify the maximum ground vibration resulting from OD blasts.*

   Response: See Section 4.14.1 of the revised OB/OD Part B.

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LIST OF ABBREVIATIONS/ACRONYMS

AEHA	U.S. Army Environmental Hygiene Agency
amsl	above mean sea level
CFR	Code of Federal Regulations
cm	centimeter
cm/cm	centimeter per centimeter
cm/hr	centimeters per hour
dB	decibels
DOE	U.S. Department of Energy
DX	LANL's Dynamic Experimentation Division
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
ESA	LANL's Engineering Sciences and Applications Division
ESH-1	LANL's Health Physics Operations Group
ESH-5	LANL's Industrial Hygiene and Safety Group
ESH-19	LANL's Hazardous and Solid Waste Group
IRF	Inspection Record Form
LACFD	Los Alamos County Fire Department
LANL	Los Alamos National Laboratory
LDR	land disposal restrictions
μg/L	micrograms per liter
MSDS	material safety data sheet
20 NMAC 4.1	New Mexico Administrative Code, Title 20, Chapter 4, Part 1
NMED	New Mexico Environment Department

LIST OF ABBREVIATIONS/ACRONYMS (Continued)

NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
OB	open burning
OD	open detonation
PCB	polychlorinated biphenyl
PPE	personal protective equipment
ppm	part per million
QAPjP	quality assurance project plan
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAL	screening action level
SAP	sampling and analysis plan
SOP	standard operating procedure
SVOC	semivolatile organic compound
SW-846	EPA's "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"
SWMU	solid waste management unit
SWPP	Storm Water Pollution Prevention
TA	technical area
TCLP	toxicity characteristic leaching procedure
USCS	Unified Soil Classification System
VOC	volatile organic compound
WAP	waste analysis plan

1.0 INTRODUCTION

This unit-specific Part B permit application has been prepared for submittal to the New Mexico Environment Department (NMED) to meet certain requirements of the New Mexico Hazardous Waste Act and implementing regulations, specifically, the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), revised November 1, 1995. The U.S. Environmental Protection Agency (EPA), Region 6, is also being provided with a copy of this unit-specific Part B permit application. General information applicable to all waste management units at Los Alamos National Laboratory (LANL) is provided in the "General Part B Permit Application Information for Los Alamos National Laboratory" (LANL, 1996a), hereinafter referred to as the LANL General Part B. This unit-specific Part B permit application contains only the information specific to the waste management units addressed herein; the LANL General Part B addresses other permit application requirements and is referenced in this document, as appropriate.

This unit-specific Part B permit application addresses the open burning/open detonation (OB/OD) thermal treatment units at Technical Area (TA) 14, TA-15, TA-36, and TA-39 that have been previously included in a LANL Part A permit application submittal. The Part A permit application for hazardous waste (LANL, 1988) was submitted to NMED in November 1988 and included waste management units at the TAs addressed in this unit-specific Part B permit application. In accordance with direction from NMED, a unit-specific Part A permit application (LANL, 1997) for the waste management units addressed in this unit-specific Part B permit application is being submitted to NMED, pursuant to 20 NMAC 4.1, Subpart IX, 270.72, revised November 1, 1995. The unit-specific Part A permit application, hereinafter referred to as the OB/OD Part A, is being submitted with this unit-specific Part B permit application as a separate document (LANL, 1997). Following is a list of the hazardous waste management units at TA-14, TA-15, TA-36, and TA-39 for which this unit-specific Part B permit application is being submitted.

- **TA-14: Two Thermal Treatment Units**, included in LANL's Resource Conservation and Recovery Act (RCRA) Part A permit application for hazardous waste, comprise an OB unit and an OD unit near TA-14, Building 23 (TA-14-23). These units may be used to treat hazardous explosive waste by OB and OD, respectively. (A definition of *hazardous waste* is provided in Section 3.0 of this unit-specific Part B permit application.)

- **TA-15: A Thermal Treatment Unit**, included in LANL's RCRA Part A permit application for hazardous waste, is an OD unit near TA-15-184. This unit may be used to treat hazardous explosive waste by OD.

- **TA-36: A Thermal Treatment Unit**, included in LANL's RCRA Part A permit application for hazardous waste, is an OD unit near TA-36-8. This unit may be used to treat hazardous explosive waste by OD.

- **TA-39: Two Thermal Treatment Units**, included in the 1988 Part A permit application, are OD units near TA-39-6 and TA-39-57. These units may be used to treat hazardous explosive waste by OD.

In both the Part A and Part B permit applications, a unit to be permitted may sometimes be referred to as a "facility" (e.g., the Drum Prep Facility). The term "facility," as it appears in this context, is used only to denote building names and does not imply the regulatory meaning of "facility" as defined in 20 NMAC 4.1, Subpart I, 260.10, revised November 1, 1995. However, pursuant to 20 NMAC 4.1, Subpart I, 260.10, revised November 1, 1995, the LANL facility as a whole does meet the regulatory definition of a facility.

Table 1-1 provides a list of regulatory references and the corresponding section location in the unit-specific and/or the LANL General Part B permit application(s). Where applicable, regulatory citations in this unit-specific Part B permit application and in the LANL General Part B permit application reference 20 NMAC 4.1, which adopts, with a few limited exceptions, the Code of Federal Regulations, Title 40, Parts 260 to 266, Part 268, and Part 270.

Table 1-1

Regulatory References and Corresponding Permit Application Location

Regulatory Reference[a] 20 NMAC 4.1, Subpart IX	20 NMAC 4.1, Subparts V and VI[b]	Description of Requirement	Location in this Part B Permit Application	Location in General Part B Permit Application
270.10(a)	--	Permit application	Entire Document	Entire Document
270.10(g)(1)	--	Updating permit application	1.0	1.0
270.11(a)	--	Signatories	12.0	12.0
270.11(d)	--	Certification	12.0	12.0
270.13	--	Contents of Part A permit application	Part A[c]	NA[d]
270.13(a)	--	Activities conducted	Part A	NA
270.13(b)	--	Name, mailing address, and location	Part A	NA
270.13(c)	--	Principal standard industrial classification codes	Part A	NA
270.13(d)	--	Operator information	Part A	NA
270.13(e)	--	Owner information	Part A	NA
270.13(f)	--	Whether located on Indian lands	Part A	NA
270.13(g)	--	New or existing facility	Part A	NA
270.13(h)	--	Scale drawing and photographs	Part A	NA
270.13(i)	--	Description of waste processes	Part A	NA
270.13(j)	--	Specification and quantity of hazardous waste	Part A	NA
270.13(k)	--	List of permits and construction approvals	Part A	NA
270.13(l)	--	Topographic maps	Part A/2.0	NA
270.13(m)	--	Description of nature of business	Part A	NA
270.13(n)	--	Hazardous debris	Part A	NA
270.14(b)(1)	--	General facility description	2.0	2.0
270.14(b)(2)	264.13(a)	Chemical and physical analyses	3.0	3.0
270.14(b)(3)	264.13(b)	Waste analysis plan	3.0	3.0
	264.13(b)(1)	Parameters and rationale	3.0	NA

Refer to footnotes at end of table.

Table 1-1 (Continued)

Regulatory References and Corresponding Permit Ap[illegible]cation Location

Regulatory Reference[a] 20 NMAC 4.1, Subpart IX	20 NMAC 4.1, Subparts V and VI[b]	Description of Requirement	Location in this Part B Permit Application	Location in General Part B Permit Application
	264.13(b)(2)	Test methods	3.0	NA
	264.13(b)(3)	Sampling methods	3.0	NA
	264.13(b)(4)	Frequency of analyses	3.0	3.0
	264.13(b)(5)	Waste analysis for off-site facilities	3.0	NA
270.14(b)(4)	264.14	Security procedures and equipment	5.0	NA
270.14(b)(5)	264.15	General inspection requirements	6.0	6.0
	265.377	Monitoring and inspections for thermal treatment units	4.0	6.0
270.14(b)(7)	264 Subpart D	Contingency Plan	7.0	7.0
	264.51	Contingency plan design and implementation	7.0	7.0
	264.52(a) & (c–f)	Contingency plan content	NA	7.0
	264.52(e) & (f)	Contingency plan content	7.0	--
	264.53	Contingency plan copies	NA	7.1
	264.54	Contingency plan amendment	NA	7.13
	264.55	Emergency coordinator	NA	7.1.1
	264.56	Emergency procedures	NA	7.3 - 7.12
270.14(b)(8)	264 Subpart C	Preparedness and prevention	5.0	5.0
	264.31	Design and operation of facility	4.0/5.0	4.0/5.0
	264.32	Required equipment	5.0	NA
	264.33	Testing and maintenance of equipment	5.0	NA
	264.34	Communications/alarm system	5.0	NA
	264.35	Required aisle space	5.0	NA
	264.37	Arrangements with local authorities	NA	5.0/7.0
270.14(b)(9)	264.17	Prevention of accidental ignition or reaction	4.0/5.0	NA
270.14(b)(10)	--	Traffic patterns, volume, and controls	2.0	2.3

Refer to footnotes at end of table.

Table 1-1 (Continued)

Regulatory References and Corresponding Permit Application Location

Regulatory Reference[a]				
20 NMAC 4.1, Subpart IX	20 NMAC 4.1, Subparts V and VI[b]	Description of Requirement	Location in this Part B Permit Application	Location in General Part B Permit Application
270.14(b)(11)(i) & (ii)	264.18(a)	Seismic standard	2.0	2.2.1
270.14(b)(11)(iii)	264.18(b)	Floodplain standard	2.0	2.2.2
270.14(b)(12)	264.16	Personnel training	NA	8.0
270.14(b)(13)	264 Subpart G	Closure and post-closure plans	9.0	9.0
	264.111	Closure performance standard	NA	9.1.1
	264.112(a) & (b)	Written content of closure plan	9.0	9.0
	264.112(c)	Amendment of closure plan	NA	9.1.4
	264.112(d)	Notification of partial and final closure	NA	9.1.2
	264.112(e)	Removal of wastes and decontamination/dismantling of equipment	9.0	NA
	264.113	Time allowed for closure	NA	9.1.3
	264.114	Disposal/decontamination	9.0	NA
	264.115	Certification of closure	NA	9.1.6
	264.116	Survey plat	NA	9.1.10
	264.117	Post-closure care and use of property	NA	9.1.10
	264.118	Post-closure plan; amendment of plan	NA	9.1.10
	264.119	Post-closure notices	NA	9.1.10
	264.120	Certification of post-closure	NA	9.1.10
270.14(b)(19)(i) (vi)(vii) & (x)	--	Topographic maps	Part A	2.1.2
270.14(b)(19)(ii)	264.18(b)	100-year floodplain	2.0	2.2.2
270.14(b)(19)(iii)	--	Surface waters	Part A/4.0	2.1.3
270.14(b)(19)(iv)	--	Land use	NA	2.1.5
270.14(b)(19)(v)	--	Wind rose	NA	2.1.4
270.14(b)(19)(viii)	264.14(b)	Access control	5.0	NA

Refer to footnotes at end of table.

Table 1-1 (Continued)

Regulatory References and Corresponding Permit Application Location

Regulatory Reference[a] 20 NMAC 4.1, Subpart IX	20 NMAC 4.1, Subparts V and VI[b]	Description of Requirement	Location in this Part B Permit Application	Location in General Part B Permit Application
270.14(b)(19)(ix)	--	Wells	Part A	2.1.3
270.14(b)(19)(xi)	--	Drainage barriers	Part A/4.0	NA
270.14(b)(19)(xii)	--	Location of operational units	2.0	2.1
270.14(b)(20)	--	Other federal laws	NA	11.0
270.14(c)	264 Subpart F	Groundwater monitoring requirements	2.0/4.0	2.2.5.1
270.14(d)(1)	--	Requirements for solid waste management units (SWMU)	10.0	NA
270.14(d)(1)(i)	--	Location of SWMUs on topographic map	10.0	NA
270.14(d)(1)(ii)	--	Types of SWMUs	10.0	NA
270.14(d)(1)(iii)	--	Structural description of SWMUs	10.0	NA
270.14(d)(1)(iv)	--	Dates of operation	10.0	NA
270.14(d)(1)(v)	--	Waste types managed at SWMU	10.0	NA
270.14(d)(2)	--	Information on releases from SWMUs	10.0	NA
270.23	264 Subpart X	Miscellaneous units	4.0	NA
270.23(a)	264.601	Detailed unit description	4.0	NA
270.23(b)	264.601	Hydrologic, geologic, and meteorologic assessments	2.0/4.0	2.0
270.23(c)	264.601	Potential exposure pathways	4.0	NA
270.23(d)	--	Demonstration of treatment effectiveness	4.0	NA
	264.602	Monitoring, analysis, inspection, response, reporting, and corrective action	4.0/6.0/10.0	4.0/6.0
	264.603	Post-closure care	9.0	9.0
	265 Subpart P	Thermal treatment	4.0	NA
	265.373	General operating requirements	4.0	NA
	265.375	Waste analysis	3.0/4.0	NA

Refer to footnotes at end of table.

Table 1-1 (Continued)

Regulatory References and Corresponding Permit Application Location

Regulatory Reference[a] 20 NMAC 4.1, Subpart IX	20 NMAC 4.1, Subparts V and VI[b]	Description of Requirement	Location in this Part B Permit Application	Location in General Part B Permit Application
	265.377	Monitoring and inspections	4.0	6.0
	265.381	Closure of thermal treatment units	9.0	NA
	265.382	Open burning; waste explosives	4.0	NA
	265.383	Special waste management practices	NA	NA

a The New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), adopts, with a few limited exceptions, Title 40 of the Code of Federal Regulations (40 CFR), Parts 260–266, Part 268, and Part 270 (1995). 20 NMAC 4.1, Subparts V, VI, and IX, contain equivalent regulations to 40 CFR Parts 264, 265, and 270, respectively.

b Where there are no applicable 20 NMAC 4.1, Subpart V, Part 264 standards, 20 NMAC 4.1, Subpart VI, Part 265 standards are used, when appropriate.

c Part A = Los Alamos National Laboratory "Part A Permit Application—Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39," Revision 1.0 (LANL, 1997).

d NA = not applicable.

2.0 FACILITY DESCRIPTION

The information provided in this section is submitted in accordance with the applicable requirements of the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), revised November 1, 1995. The following subject areas are addressed in this section:

- Site-specific location information for compliance with seismic and floodplain standard requirements [20 NMAC 4.1, Subpart IX, 270.14(b)(11)(i through iii), and 20 NMAC 4.1, Subpart V, 264.18(a and b), revised November 1, 1995];
- Site-specific groundwater monitoring and protection information [20 NMAC 4.1, Subpart IX, 270.14(c), and 20 NMAC 4.1, Subpart V, 264.90(a), revised November 1, 1995];
- Site-specific traffic patterns and control [20 NMAC 4.1, Subpart IX, 270.14(b)(10), revised November 1, 1995].

A Los Alamos National Laboratory (LANL)-wide facility description addressing additional regulatory requirements is provided in Section 2.0 of the "General Part B Permit Application Information for Los Alamos National Laboratory" (LANL, 1996a) (i.e., the LANL General Part B).

2.1. UNIT LOCATION/DESCRIPTION

The hazardous waste management units addressed in this Part B permit application include the following:

- Two thermal treatment units near Technical Area (TA) 14, Building 23 (TA-14-23); one for open burning (OB) of explosives-contaminated materials and one for open detonation (OD) of hazardous explosive waste.
- A thermal treatment unit near TA-15-184 for OD of hazardous explosive waste.
- A thermal treatment unit near TA-36-8 for OD of hazardous explosive waste.
- Two thermal treatment units near TA-39-6 and TA-39-57 for OD of hazardous explosive waste.

The following sections describe the hazardous waste management units addressed in this Part B permit application and the wastes managed or planned at each unit. The locations of these waste management units are shown on Maps 2 through 5 and Figures 2 through 6 of the unit-specific Part A permit application (LANL, 1997) (i.e., the OB/OD Part A). Maps 2 through 4 of the OB/OD Part A are topographic maps with a scale of 1 inch = 100 feet. Map 5 has a scale of 1 inch = 250 feet.

2.1.1 TA-14 Hazardous Waste OB/OD Thermal Treatment Units

TA-14 is located in the western portion of LANL on the southern edge of Three-Mile Mesa. Mesa-top elevations at TA-14 range from approximately 7,350 to 7,450 feet above mean sea level (amsl). TA-14 was established in 1944 to study small-explosive charges, and since that time has been actively used for the development and testing of explosives (LANL, 1994a). Structures at the site include explosives magazines, a control building, and equipment boxes.

The OB/OD thermal treatment units at TA-14 are located in the vicinity of structure TA-14-23; this area is referred to as Q-Site East. The locations of these units are shown on Map 2 and Figure 2 of the OB/OD Part A. OB operations are conducted in a burn cage located adjacent to Firing Mound 3. Hazardous explosive waste treated (i.e., open burned) in the burn cage includes explosives-contaminated materials. The OD treatment area is located approximately 180 feet south of TA-14-23 on Firing Mound 3 and is used to treat (i.e., open detonate) hazardous explosive waste. Nontreatment-related, experimental test detonations are also performed at TA-14, Q-Site East.

2.1.2 TA-15 Hazardous Waste OD Thermal Treatment Unit

TA-15 is located on a mesa that is bifurcated by Potrillo Canyon. Mesa-top elevations at TA-15 range from approximately 6,800 to 7,280 feet amsl. TA-15 is primarily a firing site with supporting offices where research is conducted with various types of explosives (LANL, 1993a).

The OD thermal treatment unit, located near TA-15-184 at the eastern end of TA-15, extends approximately 150 feet to the northeast and southeast of TA-15-184, as shown on Map 3 and Figure 3 of the OB/OD Part A. Solid and liquid hazardous explosive waste may be treated (i.e., open detonated) at this unit. Nontreatment-related experimental test detonations (i.e., shots) are also currently performed at this location.

2.1.3 TA-36 Hazardous Waste OD Thermal Treatment Unit

TA-36 is spread over several mesa tops between a branch of Pajarito Canyon to the north and Water Canyon to the south. Mesa-top elevations at TA-36 range from approximately 6,380 to 7,120 feet amsl. TA-36 contains several other firing sites and supporting offices where research is conducted with various types of explosives (LANL, 1993b).

The OD thermal treatment unit near TA-36-8 is located in the southern portion of TA-36. The unit includes an irregularly shaped area near TA-36-8, as shown on Map 4 and Figure 4 of the OB/OD Part A. Solid and liquid hazardous explosive waste may be treated (i.e., open detonated) at the unit. Nontreatment-related experimental test detonations (i.e., shots) are also currently performed at this location.

2.1.4 TA-39 Hazardous Waste OD Thermal Treatment Units

TA-39 is located in the southern portion of LANL and includes much of the mesa between Water Canyon on the north and Ancho Canyon on the south (LANL, 1993c). Mesa-top elevations at TA-39 range from approximately 6,500 to 7,000 feet amsl. The area was established in 1959 for testing of explosive materials and has been used continuously for that purpose. TA-39 contains a number of structures located in the north fork of Ancho Canyon (LANL, 1993c). The remainder of TA-39 is unoccupied and serves as a buffer zone for open detonation operations.

The two OD thermal treatment units at TA-39 are associated with structures TA-39-6 and TA-39-57. The locations of these units are shown on Map 5 and Figures 5 and 6 of the OB/OD Part A. These units may be used to treat solid hazardous explosive waste by OD. Nontreatment-related, experimental test detonations are also performed at these locations.

2.2 LOCATION INFORMATION

2.2.1 Seismic Standard [20 NMAC 4.1, Subpart IX, 270.14(b)(11)(i and ii) and 20 NMAC 4.1, Subpart V, 264.18(a)]

The hazardous waste management units addressed in this Part B permit application are exempt from the seismic standards in 20 NMAC 4.1, Subpart IX, 270.14(b)(11), and 20 NMAC 4.1, Subpart V, 264.18(a), revised November 1, 1995, because these units existed prior to January 25, 1985, when the State of New Mexico received hazardous waste authorization.

Consistent with the criteria provided in 20 NMAC 4.1, Subpart IX, 270.10(e) and 270.14(b)(11)(i), and 20 NMAC 4.1, Subpart V, 264.18(a), revised November 1, 1995, the waste management units addressed in this Part B permit application existed prior to the effective date of regulations; thus, seismic standards are not applicable.

2.2.2 Floodplain Standard [20 NMAC 4.1, Subpart IX, 270.14(b)(11)(iii) and 270.14(b)(19)(ii); 20 NMAC 4.1, Subpart V, 264.18(b)]

In accordance with 20 NMAC 4.1, Subpart IX, 270.14(b)(11)(iii), revised November 1, 1995, the OB/OD thermal treatment units addressed in this Part B permit application are not located within the 100-year floodplain boundary. The units at TA-14, TA-15, and TA-36 are located on mesa tops. The units at TA-39 are not on a mesa top; however, a survey conducted in September 1996 indicates that these units are not within the 100-year floodplain boundary (McLin, 1996). Additional information regarding the 100-year floodplain boundary is provided in the LANL General Part B.

2.2.3 Soils

The following sections describe the soils in the vicinity of each of the OB/OD thermal treatment units addressed in this Part B permit application.

2.2.3.1 TA-14 Soils

Soils in the vicinity of the OB/OD thermal treatment units at TA-14 are Carjo loam and are classified in the Unified Soil Classification System (USCS) as loam, clay loam, and clay loam-loam. Color and texture of Carjo soils vary with depth. From 0 to 10 centimeters (cm), these soils are a grayish-brown loam or very fine sandy loam. From 10 to 50 cm, the soils are brown or reddish-brown clay loam or clay. Between 50 and 63 cm, Carjo soils are a light brown, very fine sandy loam. Permeability in the upper (i.e., 0 to 10 cm) and lower (i.e., 50 to 63 cm) regions ranges from 1.5 to 5.0 cm per hour (cm/hr); in the middle region (i.e., 10 to 50 cm), permeability varies from 0.15 to 5.0 cm/hr. The shrink-swell potential is low in the upper and lower regions and moderate in the middle region. Soil pH ranges from 6.3 to 7.8. Available water-holding capacity ranges from 0.14 to 0.21 cm per cm (cm/cm). Vegetation native to Carjo series soils include blue and black grama and ponderosa pine (Nyhan et al., 1978).

2.2.3.2 TA-15 and TA-36 Soils

Soils at TA-15 in the vicinity of TA-15-184 and at TA-36 in the vicinity of TA-36-8 are Nyjack sandy loam and are classified in the USCS as sandy loam, sandy loam-sandy clay, loam, clay loam-loam, and clay loam. Nyjack soils typically range from a brown loam, a very fine sandy loam, or a sandy loam approximately 10 cm thick to a subsoil of brown clay loam approximately 50 cm thick. The substratum is typically a gravelly sandy loam about 40 cm thick. Permeability rates range from 5 to 15 cm/hr in the top layer to 1.5 to 15 cm/hr in the lower layers. The shrink-swell potential is low in the top layer, with a moderate shrink-swell potential existing in the clay loam layer. Available water-holding capacity is 0.07 to 0.21 cm/cm, and the soil pH ranges from 6.1 to 7.8. Vegetation typical for this soil type is mainly piñon pine, one-seed juniper, and blue grama (Nyhan et al., 1978).

2.2.3.3 TA-39 Soils

Soils in the vicinity of the OD thermal treatment units at TA-39 are Totavi series soils and are classified in the USCS as gravelly loamy sand or sandy loam. Totavi soils are brown, gravelly loamy sand to a depth of approximately 150 cm. The permeability rate in Totavi soils is greater than 51 cm/hr and the shrink-swell potential is considered low. Water-holding capacity varies from 0.06 to 0.08 cm/cm. The pH of Totavi series soils ranges from 6.6 to 7.8. Native vegetation is blue grama, piñon pine, one-seed juniper, and annual grasses and forbs (Nyhan et al., 1978).

2.3 GROUNDWATER MONITORING [20 NMAC 4.1, Subpart IX, 270.14(c) and 20 NMAC 4.1, Subpart V, 264.90(a)]

Requirements for groundwater monitoring and protection specified in 20 NMAC 4.1, Subpart IX, 270.14(c), and 20 NMAC 4.1, Subpart V, 264.90(a), revised November 1, 1995, apply to owners and operators of the following "regulated units" only: surface impoundments, waste piles, land treatment units, and landfills. This document addresses thermal treatment units, which are not regulated units subject to 20 NMAC 4.1, Subpart IX, 270.14(c), revised November 1, 1995. For additional information on groundwater monitoring, see Section 4.6.1 of this document.

2.4 TRAFFIC PATTERNS AND CONTROL [20 NMAC 4.1, Subpart IX, 270.14(b)(10)]

The OB/OD thermal treatment units addressed in this Part B permit application are used to treat hazardous waste generated at various TAs at LANL. Waste generated off site may also be treated at these units.

2.4.1 Routes of Travel

The primary traffic routes that may be used to transport hazardous explosive waste to the thermal treatment units at TA-14, TA-15, and TA-36 include State Road 501 (West Jemez Road), Contractor's Road, R-Site Road, and Potrillo Drive (Figures 2-1 through 2-3 in this section and Figure 2-10 in the LANL General Part B). The primary traffic routes that may be used to transport hazardous explosive waste to TA-39 include State Road 4, State Road 501, Pajarito Road, and Ancho Road (Figures 2-4 and 2-5 in this section and Figure 2-10 in the LANL General Part B).

2.4.2 Traffic Control Signals

Traffic control signals within TA-14, TA-15, TA-36, and TA-39 in the vicinity of the waste management units addressed in this Part B permit application include stop signs, posted speed limits, and other traffic and pedestrian control signs. The locations of existing signs at these TAs in the vicinity of these waste management units are shown on Figures 2-1 through 2-5 of this section.

2.4.3 TA-14

Due to the nature of operations at TA-14 and because the TA is in a secured area, traffic volume in the area of the OB/OD units at TA-14 is minimal (typically about 10 vehicles per month). Vehicle types are generally cars and light- and medium-duty trucks and vans. Vehicles are usually parked in the parking area adjacent to TA-14-23; occasionally, a truck or van may drive on the gravel road adjacent to the OB/OD units.

Roads within TA-14 are generally two-lane roads with asphaltic concrete surfaces. Load-bearing capacity for these roads is 32,000 pounds per axle. They are typically constructed with a 6-inch-thick base overlain with a 6- to 8-inch asphaltic concrete surface and are designed and constructed to meet American Association of State Highway Transportation Officials standards.

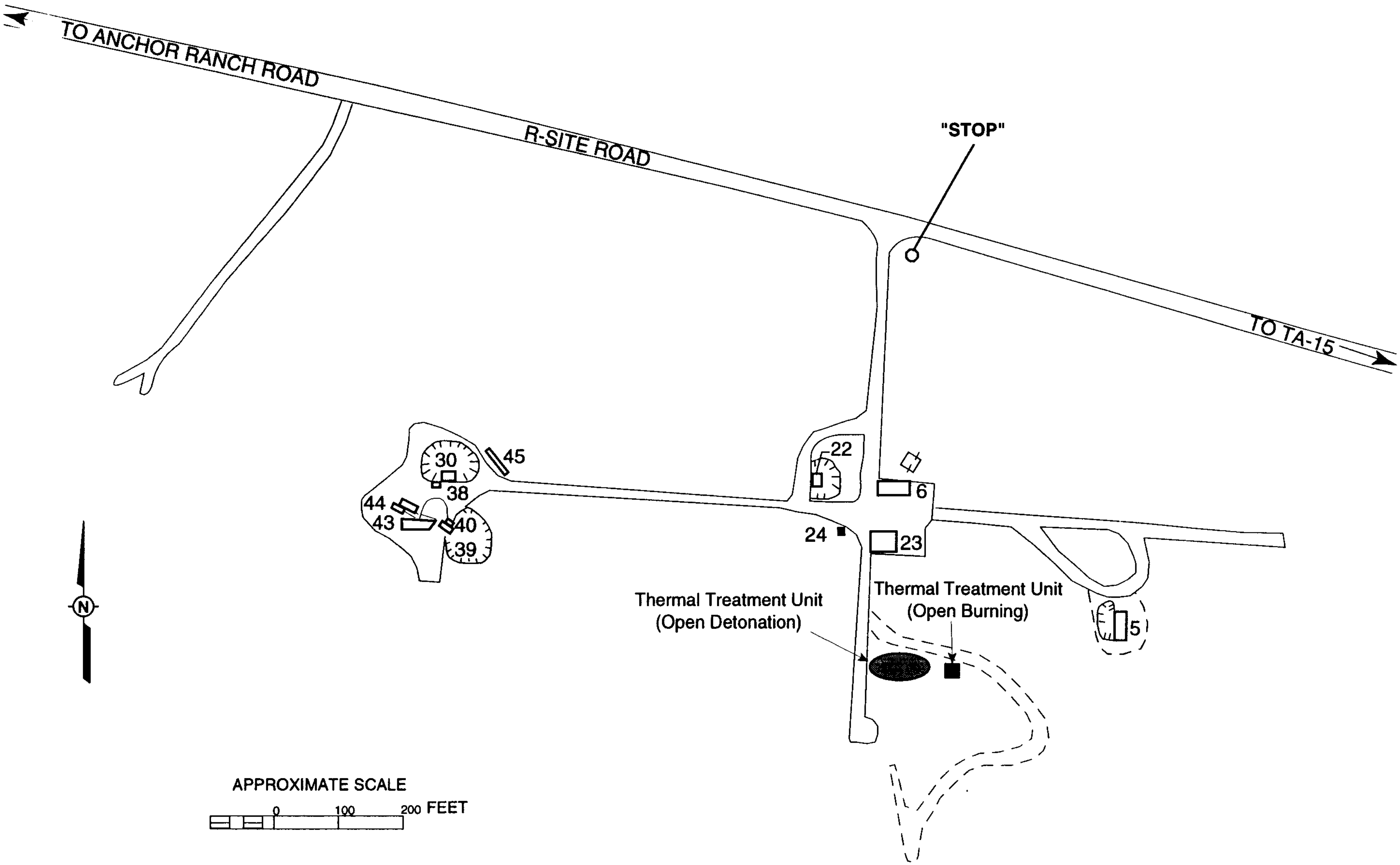

Figure 2-1
Location Map of Access Roads and Traffic Control Signs in the Vicinity of the Thermal Treatment Units near Technical Area (TA) 14, Building 23

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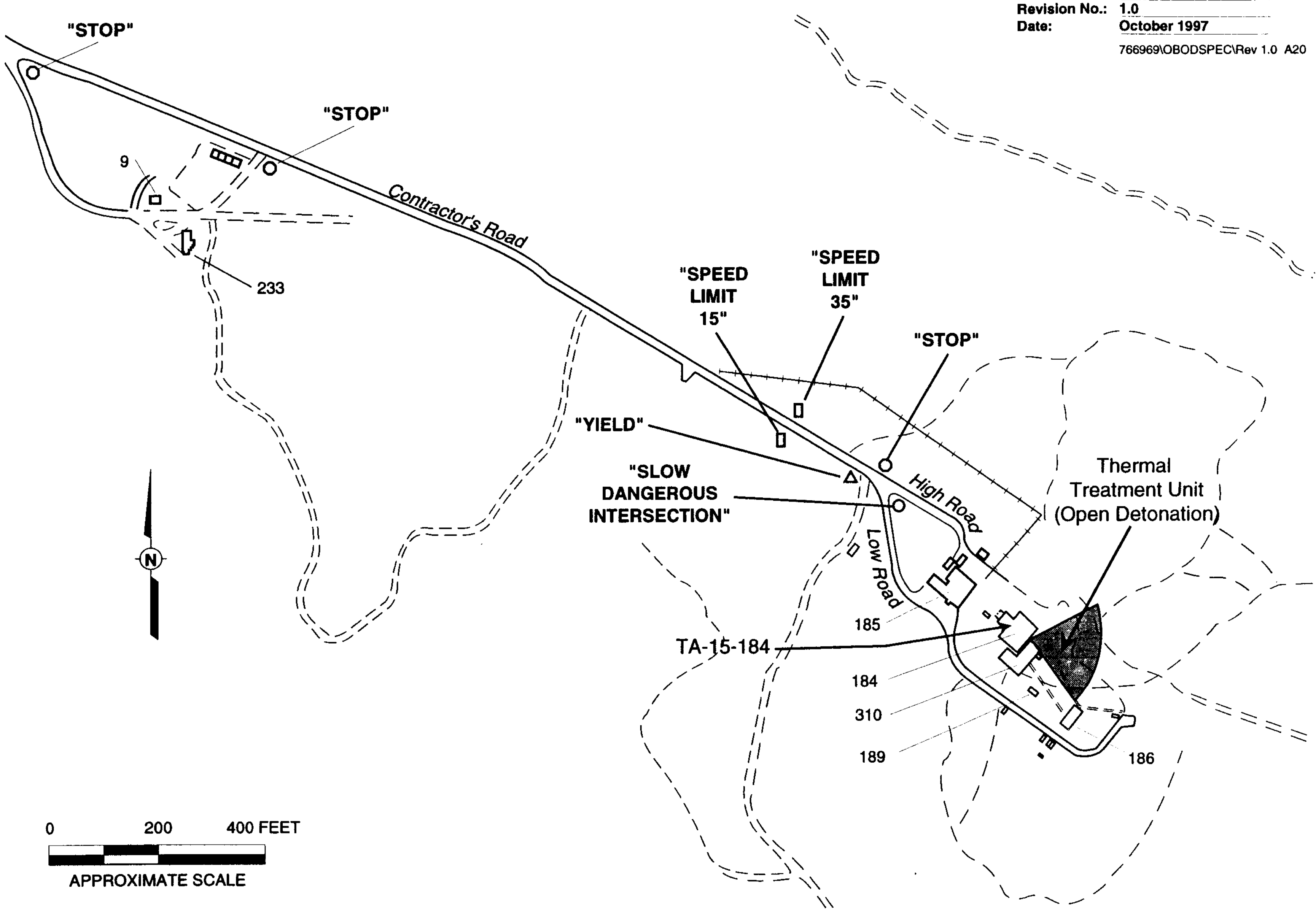

Figure 2-2

Location Map of Access Roads and Traffic Control Signs
in the Vicinity of the Thermal Treatment Unit near Technical Area (TA) 15, Building 184

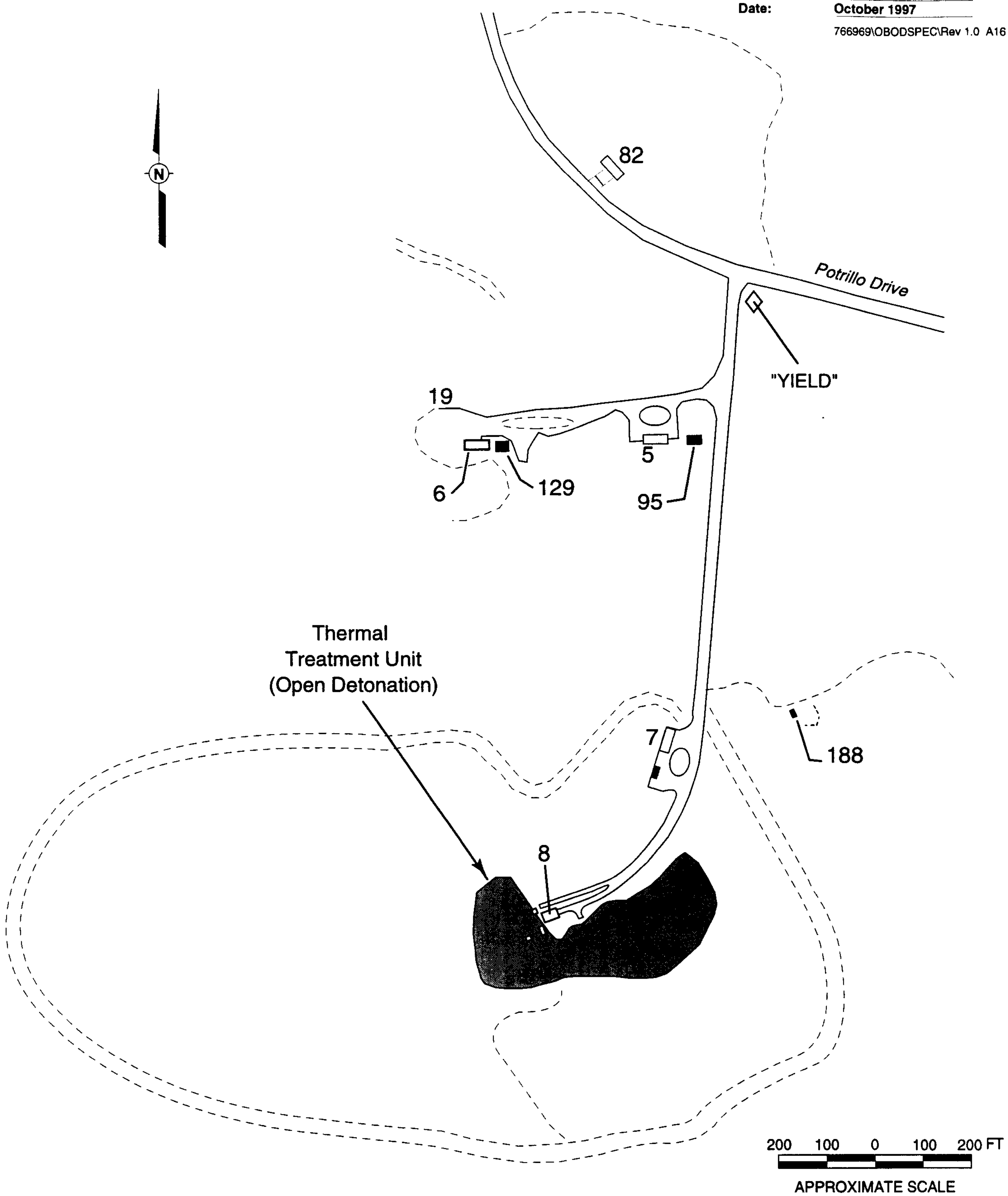

Figure 2-3
Location Map of Access Roads and Traffic Control Signs
in the Vicinity of the Thermal Treatment Unit near Technical Area 36, Building 8

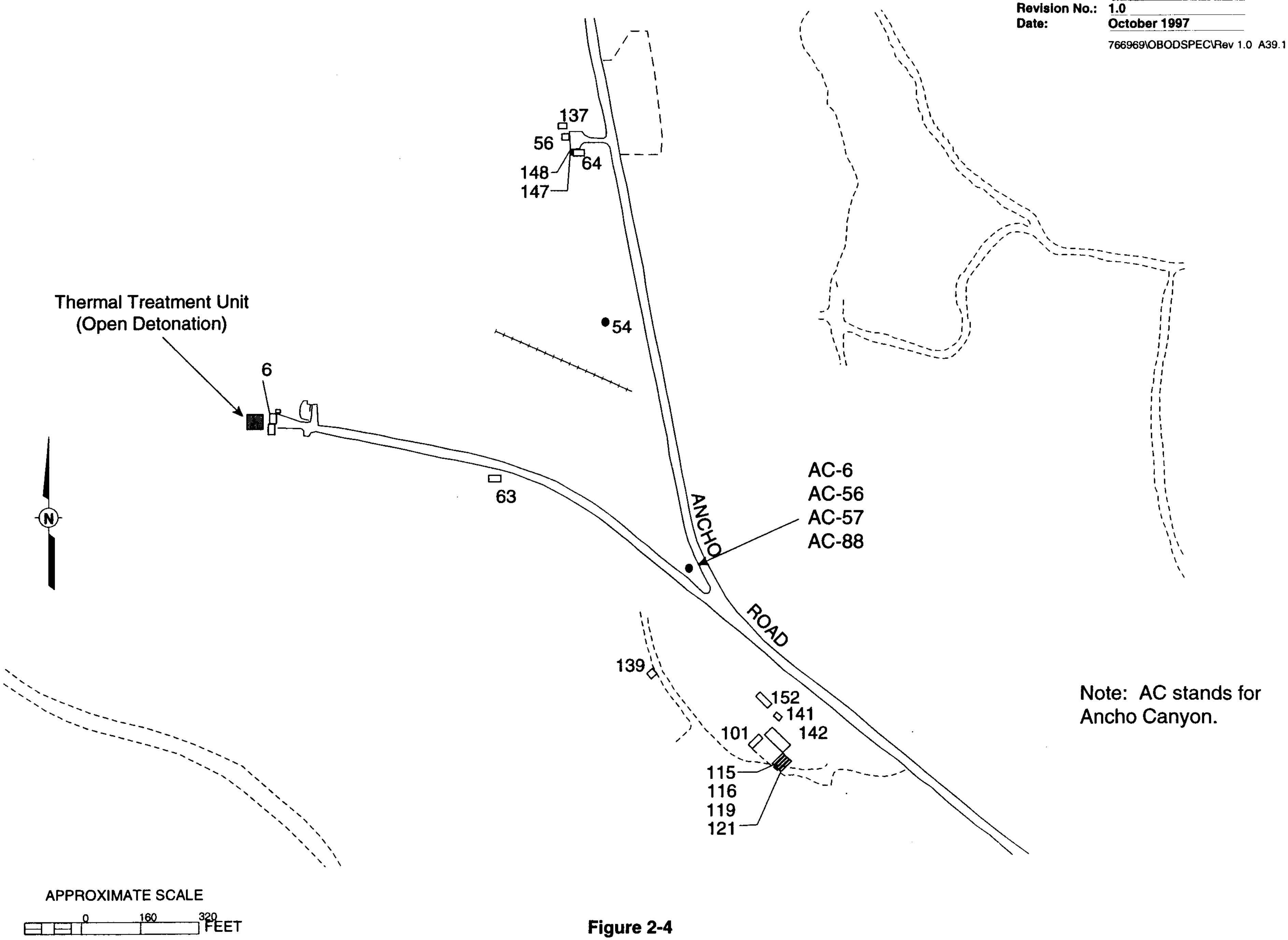

Figure 2-4
Location Map of Access Roads and Traffic Control Signs in the Vicinity of the Thermal Treatment Unit near Technical Area 39, Building 6

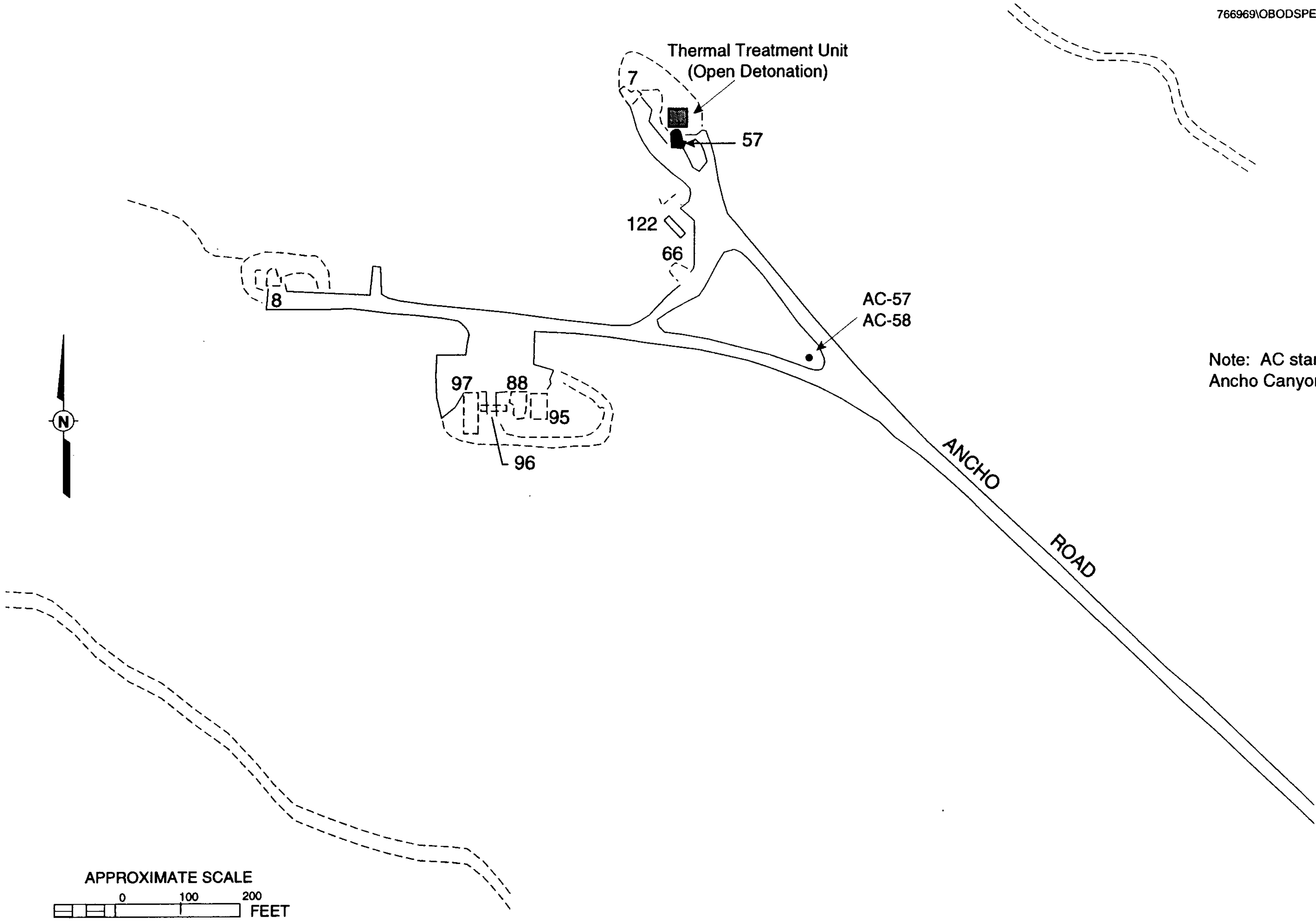

Figure 2-5
Location Map of Access Roads and Traffic Control Signs in the Vicinity of the Thermal Treatment Unit near Technical Area 39, Building 57

WASTE ANALYSIS PLAN FOR THERMAL TREATMENT BY OPEN BURNING AND OPEN DETONATION

LIST OF DEFINITIONS

Acceptable knowledge - A term broadly defined to include process knowledge, any waste analysis data, and/or facility records of analysis.

Explosive - Any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, shock, or other suitable initiation stimulus, undergoes a very rapid chemical change with the evolution of large volumes of highly-heated gases that exert pressures in the surrounding medium. The term applies to materials that either detonate or deflagrate.

Hazardous waste - The criteria for establishing a waste as a hazardous waste are provided in the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), Subpart II, revised November 1, 1995. A waste is considered hazardous if it meets the definition of a solid waste described in 20 NMAC 4.1, Subpart II, 261.2, revised November 1, 1995; is not exempt from regulation; and exhibits one or more of the characteristics described in 20 NMAC 4.1, Subpart II, Part 261, Subpart C, revised November 1, 1995, or is listed in 20 NMAC 4.1, Subpart II, Part 261, Subpart D, revised November 1, 1995.

Heterogeneous waste - Waste that is of dissimilar or diverse composition.

Homogeneous waste - Waste that is of uniform composition.

Open burning - The combustion of any material without control of combustion air to maintain adequate temperature for efficient combustion; without containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion; and without control of emission of the gaseous combustion products.

Open detonation - An explosion in which chemical transformation passes through the material faster than the speed of sound.

Process knowledge - Described in 20 NMAC 4.1, Subpart V, 264.13(a)(2), revised November 1, 1995, as data developed under Subpart II and existing published or documented data on a specific hazardous waste or on hazardous waste generated from similar processes.

LIST OF DEFINITIONS
(Continued)

Solid physical form waste - Any waste stream in a solid physical form. In this document, use of the term "solid physical form waste" has no additional regulatory meaning.

Solid waste - Any waste stream that meets the definition of a "solid waste" as specified in 20 NMAC 4.1, Subpart II, 261.2, revised November 1, 1995.

Thermal treatment - The treatment of hazardous waste that uses elevated temperatures as the primary means to change the chemical, physical, or biological character or composition of the hazardous waste, pursuant to 20 NMAC 4.1, Subpart I, 260.10, revised November 1, 1995.

3.0 WASTE ANALYSIS PLAN FOR THERMAL TREATMENT BY OPEN BURNING AND OPEN DETONATION

This waste analysis plan (WAP) presents information on the chemical and physical nature of hazardous explosive waste treated at Los Alamos National Laboratory (LANL), Technical Area (TA) 14, TA-15, TA-36, and TA-39. The waste analysis information contained herein is specific to thermal treatment by open burning (OB) or open detonation (OD) (see List of Definitions). The content of this WAP generally follows the guidance provided in "Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes—A Guidance Manual" (U.S. Environmental Protection Agency [EPA], 1994a); and "RCRA Part B Permit Writers' Guidance Manual for Department of Defense Open Burning/Open Detonation Units" (U.S. Army Environmental Hygiene Agency [AEHA], 1987).

Hazardous waste is defined and regulated by the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), revised November 1, 1995. This WAP addresses *hazardous waste* as defined in the List of Definitions. LANL-wide WAP information is presented in Section 3.0 of the LANL General Part B.

This WAP is organized as follows. Section 3.1 provides information on hazardous explosive waste-generating processes and activities, including a facility description, identification of wastes managed, and discussion of associated treatment units. Section 3.2 presents waste parameters, including the criteria and rationale for selection. Section 3.3 includes requirements for the characterization of hazardous explosive waste. Section 3.4 provides verification analysis requirements. Section 3.5 addresses special procedural requirements (i.e., procedures for ignitable, reactive, and incompatible waste and procedures to ensure compliance with land disposal restrictions [LDR] requirements). LANL's waste profiling system is discussed in Section 3.0 of the LANL General Part B.

3.1 FACILITY WASTE-GENERATING PROCESSES, ACTIVITIES, AND IDENTIFICATION OF HAZARDOUS EXPLOSIVE WASTE MANAGED

Hazardous explosive wastes are generated at LANL primarily from research and development activities. Table 3-1 provides information on potential hazardous explosive waste treated by OB/OD at LANL, including brief waste descriptions, waste-generating processes, waste-generating locations, the characterization basis for hazardous waste designation (i.e., process knowledge and/or analysis), potential EPA Hazardous Waste Number(s), potential hazardous constituents in and/or characteristics of the waste, and regulatory limits. As indicated in Table 3-1, the F005 wastes are spent non-halogenated solvents. They may include toluene and methyl ethyl ketone potentially present on explosives-contaminated rags or wipes. Table 3-2 provides information on waste parameters, characterization methods, and rationale for parameter selection.

Explosive waste is generated by the Dynamic Experimentation (DX) and Engineering Sciences and Applications (ESA) Divisions as a result of research and development or testing activities. The explosive compounds are generally nitrated organic compounds such as trinitrotoluene, nitrocellulose, trinitramines, and pentaerythritoltetranitrate. Metals may also be associated with the explosives. Barium in the form of barium nitrate or barium carbonate is a common component of explosives (e.g., the explosive Baratol may be 76 wt% barium nitrate). Because the barium level in these wastes could potentially exceed the regulatory level (100 mg/L), LANL assigned the EPA Hazardous Waste Number D005 to these wastes. Waste explosive materials may be in the form of discrete pieces, chips, or scraps. Both homogeneous and heterogeneous waste forms exist, as described in the following sections.

LANL does not treat non-reactive wastes at the OB/OD units at TA-14. Ancillary components (e.g., containers, housing, and casings) used during waste treatment consist of nonhazardous materials only (e.g., aluminum, plastic).

3.1.1 Homogeneous Hazardous Explosive Waste

Homogeneous (i.e., uniform composition) hazardous explosive waste treated by OB/OD at LANL are described generally in the following paragraphs.

Solid Hazardous Explosive Waste

Solid hazardous explosive waste consists of off-specification explosives.

Scrap Hazardous Explosive Waste

Scrap hazardous explosive waste consists primarily of discrete pieces of explosives left over from research and development activities and testing operations.

Liquid Hazardous Explosive Waste

Liquid hazardous explosive waste consists of off-specification liquid explosives.

3.1.2 Heterogeneous Solid Hazardous Explosive Waste

Heterogeneous (i.e., dissimilar or diverse composition) solid hazardous explosive waste treated by OB/OD at LANL generally consists of material from failed experimental detonations, paper/tissue (wipes), rags, oil, wood, and machine tools. These wastes are contaminated with explosives.

3.1.3 Description of the OB Unit

The OB thermal treatment unit at LANL addressed in this WAP is located at TA-14 and is currently operating under the requirements of 20 NMAC 4.1, Subpart VI, revised November 1, 1995. This unit consists of a small metal burn cage placed within a metal tray. Combustible, hazardous explosives-contaminated materials that cannot be safely transported to TA-16 are treated (i.e., open burned) in the cage.

3.1.4 Description of the OD Units

The OD thermal treatment units at LANL addressed in this WAP are currently operating under the requirements of 20 NMAC 4.1, Subpart VI, revised November 1, 1995. These units include:

- A thermal treatment unit, located approximately 180 feet south of Building 23 at TA-14 (TA-14-23), used to treat hazardous explosive waste.
- A thermal treatment unit near TA-15-184 used to treat hazardous explosive waste.
- A thermal treatment unit near TA-36-8 used to treat hazardous explosive waste.
- Two thermal treatment units located near TA-39-6 and TA-39-57 used to treat hazardous explosive waste.

Specific design features and operations of these units are fully described in Section 4.0 of this Part B permit application.

Hazardous explosive wastes are stored only at temporary staging/storage areas at the OB/OD thermal treatment units addressed in this Part B permit application.

3.2 WASTE PARAMETERS [20 NMAC 4.1, Subpart V, 264.13(a)(1)]

Parameter selection and waste characterization of explosive waste is based solely on process knowledge due to the explosive properties of the waste. Chemical and physical characterization is performed prior to treatment of hazardous explosive waste, as required by 20 NMAC 4.1, revised November 1, 1995. Waste parameters are selected to ensure that the characterization will contain all necessary information to properly treat the waste in accordance with general facility standards and LDR requirements. Characterization is performed using the procedures described in Section 3.3.

3.2.1 Proposed Analytical Parameters and Methods [20 NMAC 4.1, Subpart V, 264.13(b)(1), and Subpart IX, 270.14(b)(2)]

Proposed analytical parameters and characterization methods for the hazardous explosive waste treated by OB/OD at LANL are summarized in Table 3-2. The parameters listed in Table 3-2 were selected based on process knowledge for the various homogeneous and heterogeneous waste forms described in Sections 3.1.1 and 3.1.2. Analytical parameter selection and waste characterization of explosive waste are based solely on process knowledge due to the explosive properties of the waste.

3.2.2 Criteria and Rationale for Parameter Selection [20 NMAC 4.1, Subpart V, 264.13(b)(1)]

Waste analysis parameters were selected to characterize hazardous explosive waste in conformance with 20 NMAC 4.1, revised November 1, 1995. These parameters are based on knowledge of raw materials and physical/chemical processes of waste-generating activities. The rationale for parameter selection are identified in Table 3-2.

3.3 CHARACTERIZATION OF EXPLOSIVE WASTE

Hazardous explosive waste is not analyzed at LANL. Only limited types of explosives are used by DX and ESA Divisions, and the composition and reactive characteristics of these materials, used in testing and experiments, are well documented. Additionally, methods contained in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA, 1986a), cannot be used for explosive waste due to the explosive properties of these wastes.

Established explosives have fairly consistent chemical composition for successful experimental usage. Attachment 3-1 contains a list of established explosives and their chemical composition.

All of the compounds listed in Attachment 3-1 are highly reactive. They may be used as propellants, explosives, or pyrotechnics, depending on their intended use. For example, black powder may be used as a pyrotechnic (e.g., fireworks), as a propellant (e.g., to propel projectiles/ammunition), or as an explosive, depending on confinement conditions. Thus, the explosives listed in Attachment 3-1 have not been divided into separate lists of propellants, explosives, and pyrotechnics. Off-specification explosives contain approximately the same composition as product explosives. Off-specification explosive waste material has successfully undergone thermal treatment by OB/OD in the past, with no additional or alternative procedures required to effectively treat these wastes. Thus, explosive waste is sufficiently characterized by process knowledge (see Table 3-2). In addition, there are safety considerations that preclude routine analysis of explosive wastes.

Reevaluation of an explosive waste will occur only under the following conditions:

- Use of different raw materials (different formulation) in the product explosive
- A change in the results of the OB/OD process occurs (e.g., a difference in the visible characteristics of the resulting airborne plume or a premature detonation)
- Visual inspections of the waste indicate a change in the waste characteristics.

If plans are made to treat a hazardous explosive waste that has not previously been treated by OB/OD, LANL will collect sufficient information/documentation for the waste (i.e., Waste Profile Forms, process knowledge, material safety data sheets, or any additional information for acceptable knowledge [see Section 3.3.1]) to ensure that the waste stream can be effectively treated by OB/OD prior to initiating the treatment process.

3.3.1 Acceptable Knowledge [20 NMAC 4.1, Subpart V, 264.13(a)(2), and Subpart IX, 270.14(b)(2)]

Acceptable knowledge, as defined in the List of Definitions, is relied upon to characterize hazardous explosive waste at TA-14, TA-15, TA-36, and TA-39.

Extensive sampling and analysis of hazardous explosive waste is constrained or restricted due to dangers associated with managing explosive waste and the chemical and physical nature of hazardous explosive waste and waste forms (e.g., debris, equipment, and instruments). Factors associated with the difficulty of sampling heterogeneous waste include:

- Waste streams may contain disparate elements and thus require segregation into similar forms
- Large objects cannot be made to fill standard-size sample containers
- Laboratories may not be capable of sampling large objects (EPA, 1992).

3.3.2 Sampling and Analysis for Hazardous Explosive Waste

The inherent nature of explosive waste makes sampling and analysis dangerous. LANL personnel routinely use established explosives products of consistent and documented chemical composition for research. Historically, explosive waste has successfully undergone thermal treatment by OB/OD with no additional or alternative procedures required. Due to the possible safety and handling dangers associated with explosive waste, LANL will rely on process knowledge to characterize these wastes. Therefore, sampling and analysis of explosive waste will not occur at LANL.

QA/QC for soil sampling to be conducted as part of the proposed Soil Monitoring Program is addressed in Section 4.6.3.2. LANL proposes to conduct the Soil Monitoring Program as a distinct activity separate from waste analysis. This approach is supported by AEHA (1987), which does not require soil sampling as part of waste analysis. The presence of potential waste residues on the soil as a result of OB/OD treatment will be determined and monitored via implementation of the proposed Soil Monitoring Program, which will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602.

3.4 VERIFICATION ANALYSIS FOR HAZARDOUS EXPLOSIVE WASTE [20 NMAC 4.1, Subpart V, 264.13(a)(3)]

Verification of explosive waste is done through knowledge of process and strict administrative control of the waste generated.

Verification of process knowledge may be performed to confirm the accuracy of the initial waste characterization, to verify that treatment standards have been met, when there is a change in a waste-generating process, or when the generator requests a review. If appropriate, verification analysis for hazardous explosive waste may be conducted at LANL's or an approved subcontractor's laboratory facilities. Any verification analyses will be conducted in conformance with appropriate methods.

3.5 <u>SPECIAL PROCEDURAL REQUIREMENTS</u> [20 NMAC 4.1, Subpart V, 264.13(b)(6)]

Waste management requirements specific to ignitable, reactive, and incompatible waste, as well as for compliance with LDR regulations, are described below.

3.5.1 <u>Procedures for Ignitable, Reactive, and Incompatible Waste</u> [20 NMAC 4.1, Subpart V, 264.17]

LANL personnel take precautions necessary to prevent accidental ignition or reaction of ignitable and/or reactive waste managed at TA-14, TA-15, TA-36, and TA-39. Wastes treated by OB/OD at LANL are ignitable and/or reactive. Therefore, LANL relies on standard operating procedures for specific safety and handling procedures associated with the disposal of explosive waste. Solid physical form wastes are segregated from any potential liquid-bearing wastes within each waste management unit. Thus, ignitable and reactive wastes will not likely be capable of commingling and, therefore, would not react with other wastes or materials.

Treatment of these highly reactive wastes by open detonation is an appropriate treatment method under RCRA, is necessary to mitigate hazards associated with explosives-contaminated waste, and is the preferred waste management practice for health and safety concerns. Although LDR treatment standards for D005 and F005 specified in 40 CFR 268 are not met, attempts to remove the toxicity characteristic (D005) or the spent non-halogenated solvents (F005) prior to treatment by OB/OD to render the wastes no longer reactive (D003) or ignitable (D001) pose unacceptable safety risks.

3.5.2 <u>Procedures to Ensure Compliance with LDR Requirements</u> [20 NMAC 4.1, Subpart VIII, 268.7(a) and 268.7(b)(3), (4), and (5)]

In accordance with LDR regulations, treatment standards are expressed in two ways: (1) as constituent concentrations in the waste (from either an extract of the waste, as determined by the toxicity characteristic leaching procedure, or from the total volume of the waste, referred to as total waste analysis) or (2) as specified treatment technologies. The specified treatment technology for explosive waste (i.e., ignitable and/or reactive) is deactivation; therefore, verification through analysis is not necessary. LANL will document in its operating record that the appropriate treatment technology has been employed prior to land disposal. An example of LANL's Land Disposal Restrictions Notification Form is provided as Figure 3-2 in the LANL General Part B (LANL, 1996a).

Table 3-1

Descriptions of Hazardous Explosive Waste Treated by Open Burning/Open Detonation at Los Alamos National Laboratory

Waste Description	Waste-Generating Process Description	Technical Area (TA) Where Waste is Generated	Basis for Characterization	Potential EPA[a] Hazardous Waste Numbers	Potential Hazardous Constituents and/or Characteristics in the Waste	Regulatory Limits[b] (milligrams per liter)
Homogeneous Wastes						
Solid explosive (off-specification)	Explosives preparation	TA-14, TA-15, TA-36, and TA-39	Process knowledge	D001 D003 D005 F005	Ignitability Reactivity Barium Spent non-halogenated solvents	Not applicable (NA)[c] NA 100.0 NA
Scrap explosive (discrete process explosives)	Research and development activities and testing operations	TA-14, TA-15, TA-36, and TA-39	Process knowledge	D001 D003 D005 F005	Ignitability Reactivity Barium Spent non-halogenated solvents	NA NA 100.0 NA
Liquid explosive (off-specification)	Explosives preparation	TA-14, TA-15, TA-36, and TA-39	Process knowledge	D001 D003 D005 F005	Ignitability Reactivity Barium Spent non-halogenated solvents	NA NA 100.0 NA
Heterogeneous Wastes						
Explosives-contaminated material (material/equipment may include paper, rags, oil, wood, machine tools)	Research and development activities and testing operations	TA-14, TA-15, TA-36, and TA-39	Process knowledge	D001 D003 D005 F005	Ignitability Reactivity Barium Spent non-halogenated solvents	NA NA 100.0 NA

[a] U.S. Environmental Protection Agency.

[b] A solid waste exhibits the characteristic of toxicity if the extract from a representative sample of the waste contains any of the contaminants listed at a concentration equal to or greater than the respective value given in the New Mexico Administrative Code, Title 20, Chapter 4, Part 1, Subpart II, Part 261, Subpart D, revised November 1, 1995.

[c] Not applicable: Refers to the absence of regulatory limits for ignitable and reactive characteristic wastes.

Table 3-2

Parameters, Characterization Methods, and Rationale for Hazardous Explosive Waste

Waste Description	Parameter[a]	Characterization Method	Rationale
Solid explosive	– Barium – Spent non-halogenated solvents – Ignitability – Reactivity	– Acceptable knowledge[b]	– Determine characteristic for ignitability and reactivity – Determine toxicity characteristic – Determine presence or absence of hazardous constituents
Scrap explosive	– Barium – Spent non-halogenated solvents – Ignitability – Reactivity	– Acceptable knowledge	– Determine characteristic for ignitability and reactivity – Determine toxicity characteristic – Determine presence or absence of hazardous constituents
Liquid explosive	– Barium – Spent non-halogenated solvents – Ignitability – Reactivity	– Acceptable knowledge	– Determine characteristic for ignitability and reactivity – Determine toxicity characteristic – Determine presence or absence of hazardous constituents
Explosives-contaminated material	– Barium – Spent non-halogenated solvents – Ignitability – Reactivity	– Acceptable knowledge	– Determine characteristic for ignitability and reactivity – Determine toxicity characteristic – Determine presence or absence of hazardous constituents

a Parameter selection is based on process knowledge for each waste stream. Additional parameters may be selected for each waste stream as necessary.

b Acceptable knowledge is broadly defined as process knowledge, waste analysis data (e.g., sampling and analysis), and/or facility records of analysis in the U.S. Environmental Protection Agency (EPA), 1994, "Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Waste—A Guidance Manual," *OSWER 9938.4-03*, EPA, Office of Solid Waste and Emergency Response, Washington, D.C.

ATTACHMENT 3-1

Composition of Established Explosives

Note: The information provided in this attachment is for informational purposes only. The information is from the most current version of a Los Alamos National Laboratory standard operating procedure, which is subject to revision, when necessary.

EXPLOSIVES

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Page 3, Revision 6	Page 7, Revision 3
Page 4, Revision 8	Page 8, Revision 1

SUBMITTED J L Parkinson DATE 8/25/86
J. L. Parkinson, Group Leader, WX-3

APPROVED J L Parkinson DATE 8/25/86
J. L. Parkinson, Group Leader, WX-3

APPROVED Wm. A. Bradley DATE 8/26/86
W. A. Bradley, Asst. Division Leader, WX

APPROVED NOT REQUIRED DATE
A. M. Valentine, Group Leader, HSE-1

APPROVED Jack L. Baca for W.C.C. DATE 9/16/86
W. C. Courtright, Group Leader, HSE-3
9/16

EXPLOSIVES

I. Scope

This SOP governs the explosives that may be processed, assembled, transported, and stored at S-Site and Area 27, Able Site, NTS. Restrictions on the use of some of these explosives in processing operations may be imposed in the pertinent individual SOPS.

II. Nature and Uses of Explosives

A. Types

Explosives are compounds that will burn or explode if they are heated, exposed to some type of impact, pinched between moving surfaces, or subjected to an electric discharge or a strong shock. Not all explosives behave in the same way and, because they are not all the same, they have been divided into three classes: (1) primary or initiating, (2) boostering, and (3) secondary (bursting charge) or high explosives.

1. Primary Explosives

   a. Primary or initiating explosives are those explosives that can be detonated with very little energy. They are very sensitive to friction, heat, and impact, and some of them to an electrical discharge, and when involved in a fire they can be expected to detonate without burning. These explosives are used to "trigger" other explosives that are less sensitive and require a little more energy to get started. Explosives such as lead azide and lead styphnate fall into this category.

   b. Primary explosives are not processed at S-Site or Area 27, Able Site, NTS, but are used indirectly. Small quantities are used in squibs that are stored and used in special applications. In addition, some items that contain primary explosives, such as squibs, fuzes, low-energy detonators, and explosive bolts and fasteners, are assembled into test devices.

II. A. (cont.)

2. Booster Explosives

a. Boostering explosives are those explosives that are between the primary explosives and the secondary explosives in sensitivity. They may be set off by heat, friction, or impact, and may detonate when burned in large quantities. These explosives are normally used to detonate secondary explosives. Explosives such as PETN, RDX, HMX, and tetryl fall into this class.

* b. PETN, RDX, and HMX are processed in the first steps of making molding powders for plastic-bonded explosives (PBX) and extrudable explosives such as Extex (XTX).

c. In other S-Site processing operations, boostering explosives are mixed with diluting materials. These explosives mixtures are less sensitive than the boostering explosives themselves and are usually in the class of secondary explosives.

3. Secondary Explosives

a. Secondary or high explosives require more energy for initiation than either primary or boostering explosives. Within this class, some are more sensitive than others. All will detonate if they receive a strong enough shock from an impact or from a boostering explosive. When exposed to a fire, they will burn without detonating unless confined. The normal method of disposal is by burning, and large amounts may be burned at one time. These explosives are used for the bursting charge in conventional ordnance applications. They are used as the principal source of energy in the devices built at S-Site and Able Site, NTS. Explosive such as TNT, baratol, the cyclotols, and many of the PBXs fall into this category.

II. A. 3. (cont.)

b. Most of the explosives processed at S-Site are secondary explosives, and they are normally called high explosives.

B. Health Hazards

* Most of the explosives processed at S-Site present a possible health hazard. For this reason, one must avoid taking them into the body through either the mouth, lungs, or skin. HSE Division is aware of these hazards and keeps site personnel informed of the allowable exposures for the various operating conditions. HSE also helps with the selection of masks and other safety devices where it is determined that such a device is required.

C. Compatibility with Other Materials

1. There are times when an explosive is mixed with another material, which by itself is not an explosive, but the mixing of the two, or just the placing of the two in contact, creates an unsafe situation. Two such materials are said to be incompatible. All situations that will create such a condition are to be avoided.

2. To help assess the compatibility problem, compatibility safety checks are run. The results of these tests are used as a guide in using these materials and often cause the groups to place limitations on just how and where these materials may be used. A list of acceptable materials that may be used in specific applications is available to operating supervisors. When the material in question does not appear on the list or its use is limited and there is a requirement for its use, additional safety compatibility checks should be requested. Form WX-3-111 will be used for this purpose and will be submitted to the Group M-1 general chemistry section. Upon completion of evaluation and testing (if required), M-1 will submit their recommendations and restrictions to the WX-3 group leader, who must approve the usage of the material at S-Site and Area 27, Able Site, NTS.

II. (cont.)

D. Approval for Use

Before any explosive material can be used at S-Site and Area 27, Able Site, NTS, each lot or batch must be identified analytically by the Group M-1 analytical laboratory. Signed copies of the approved Material Release Memorandum must be furnished to THE operating personnel of Groups M-1 and WX-3 before the identified material is processed.

III. Explosives Operations

A. Explosives Area

All activities at S-Site that involve explosives, except transportation to and from other sites and laundry, are conducted in the Explosive Area. Explosives must not be removed from the Explosives Area except for those transported to other locations on WX-3 production orders or Laboratory shipping requests, and those carried out as contamination on issued apparel or explosives transportation vehicles. Transportation of explosives to and from the S-Site Explosives Area must be through the K-Site road gate near Building TA-16-220.

B. Administrative Area

1. Explosives are not allowed in the Administrative Area except for contamination on issued apparel or explosives transportation vehicles. The issued apparel is cleaned in the WX-3 laundry in Building TA-16-193 and, although the quantity of explosives involved is very small, these operations are governed by SOPs. Explosives transportation vehicles must not contain visible amounts of explosives when in the Administrative Area.

III. B. (cont.)

2. All equipment and nonexplosive materials removed from the Explosives Area and brought into the Administrative Area, or taken off-site through the gates at Security Station 560 or Building TA-16-220, must be certified clean of explosives by an S-Site Certifying Agent; exceptions are noted in Item B.1, above. Explosives transportation vehicles must be certified clean before they are sent off-site for maintenance or repairs or are released to another organization; however, routine servicing may be performed at the Building TA-16-195 garage without this certification.

3. Explosives vehicles at NTS must be certified free from explosives contamination by WX-3 personnel before being released to the REECO motor pool for maintenance.

IV. <u>Allowable Explosives at S-Site and Area 27, Able Site, NTS</u>

Explosives that may be processed at S-Site are called allowable explosives and fall into the categories of established explosives, developmental explosives and detonators. In some cases, nonexplosive additives are incorporated into these explosives. These additives are usually included in the allowable explosives in the individual SOP for a given operation.

A. Established Explosives

Some of these explosives are identified by popular names or groups of letters that are widely known in the explosives and propellants industries. The other explosives, PBX and XTX, are identified by material code numbers. These material codes are four-digit numbers that are usually written with PBX or XTX preceding them. The established explosives are listed in Table 1 of this SOP along with their nominal compositions.

IV. (cont.)

* B. Developmental Explosives

These are explosives that have been approved for development according to the procedures in the document "Los Alamos High Explosives Development (HED) Procedures and Authorization". These explosives are identified by an experimental code number of four digits preceded by X. The developmental explosives are listed in Table 2 of this SOP along with their nominal compositions, pertinent references, and weight limit restrictions.

C. Detonators

1. Types of Detonators

a. High Energy

The majority of the detonators handled and assembled into test devices at S-Site and Area 27, Able Site, NTS, are the exploding bridge wire (EBW) or 'flying foil' types that can be fired only by high energy electrical pulses. This type of detonator contains boostering explosives, but does not contain primary explosives. They are insensitive to normally encountered static charges and eletromagnetic radiation. As finished items, these detonators are not appreciably more sensitive than the high explosives used at S-Site and Able Site, Area 27, NTS. Detonators approved for use are listed in Table 3 of this SOP.

b. Low Energy

In certain applications, detonators that can be initiated by relatively low levels of energy are used. These detonators contain primary explosives. To preclude the possibility of accidental initiation from static charges or the accidental application of test voltages, all low-energy detonators received at S-Site and Able Site, Area 27, NTS, will be equipped with shorting clips. These shorting clips must remain in place at all times while the detonators are under the jurisdiction of WX-3 personnel.

IV. C. 1. b. (cont.)

Precautions to be taken in the assembly of devices with low-energy detonators are delineated in SOP 11.1.2. Low-energy detonators approved for use at S-Site and Able Site, Area 27, NTS, are listed in Table 3 of this SOP.

2. Approval for Use

Before a new type of detonator may be ordered for use at S-Site and Able Site, Area 27, NTS, its design must be checked by the WX-3 Assembly section leader. Upon his recommendation, the new type detonator will be listed as an approved detonator in Table 3 of the SOP.

3. Transportation and Storage

Detonators must be transported and stored in containers that are designed to prevent propagation from detonator to detonator and container to container. When detonators are installed into devices, they will be transported and stored with the devices.

D. Squibs

Electrically fired squibs are used by WX-3 in the disposal operations covered under SOP Chapter 22. The squibs are transported and stored in the DOT-approved containers in which they are received or in the WX-3-approved container (13Y-100279, SOP 13.1.0). The squibs approved for these operations are DuPont S-94, WX-3 Code Number 225-03, or other similar DuPont S-series squibs.

IV. (cont.)

* E. Munitions

Pending approval by the EDC, munitions with or without their fuze and arming systems can be received and stored at S-Site. The WX-3 HE Transportation and Handling Supervisor or the PMA Supervisor must receive documentation recording EDC approval prior to long-term storage of any munition. In the instance that munitions are received without proper documentation, the munition will be held in short-term storage for a period of thirty days. If written approval has not been given after thirty days, the munition will either be returned or disposed of.

* Addition

NOTE: Signature page for SOP 1.1.0 will become page 9, revision 0, on next general revision.

SUBMITTED	DATE	SUBMITTED	DATE	SUBMITTED	DATE
	7-9-87				
APPROVED		APPROVED		APPROVED	
J. L. FARKINSON	7-9-87	W. A. BRADLEY (signed: Wm. A. Bradley)	7/10/87	W. C. COURTRIGHT (signed: W C Courtright)	7/16/87

TABLE 1

ESTABLISHED EXPLOSIVES AT TA-16
NOMINAL COMPOSITIONS

Name or Code	Composition
Al ANFO[a]	Ammonium nitrate/fuel oil/aluminum power
AN	Ammonium nitrate
ANFO	Ammonium nitrate/fuel oil
Baratol	76 wt% Barium nitrate/24 wt% TNT
BDNPA	Bis(dinitropropyl) acetal
BDNPF	Bis(dinitropropyl) formal
Black powder	74 wt% Potassium nitrate/15.6 wt% charcoal/ 10.4 wt% sulfur
Boracitol	60 wt% Boric acid/40 wt% TNT
BTX[b]	5,7-Dinitro-1-picrylbenzotriazole
Composition A-3	91 wt% RDX/9 wt% beeswax

[a]For transportation only to and from M- and WX-Division Groups and storage by Group WX-3.
[b]See HED-037, For Transportation Only.
*General revision of Table 1.

Table 1 (Cont)

Name or Code	Composition
Composition A-4	97 wt% RDX/3 wt% beeswax
Composition A-5	98.5 wt% RDX/1.5 wt% beeswax
Composition B and B-3	60 wt% RDX/40 wt% TNT
Composition C-3	88 wt% RDX/12 wt% wax
Composition C-4	91 wt% RDX/2.1 wt% polyisobutylene/1.6 wt% motor oil/5.3 wt% di(2-ethylhexyl) sebacate
Cyclotol, 75/25	75 wt% RDX/25 wt% TNT
Cyclotol, 70/30	70 wt% RDX/30 wt% TNT
DATB	Diaminotrinitrobenzene
DBA-1[a]	AN/$NaNO_3$/TNT/H_2O/thickener
Detasheet C	63 wt% PETN/8 wt% NC/29 wt% elastomeric binder
Detasheet D	75 wt% PETN/25 wt% elastomeric binder Note: Although this material may be red in color, it is an explosive and not an inert material.

[a]For transportation only to and from M- and WX-Division Groups and storage by Group WX-3.

Table 1 (Cont)

Name or Code	Composition
DINGU	Dinitroglycoluril
DNPA	2,2-Dinitropropyl acrylate polymer
DNT	Dinitrotoluene
EDC-8[a]	76 wt% PETN/24 wt% Silicone rubber, MS 2420
EDC-28[b]	94 wt% RDX/6 wt% FPC 461
EDC-32[c]	85 wt% HMX/15 wt% Viton A
EDC-37[d]	91 wt% HMX/1 wt% nitrocellulose/8 wt% K-10 liquid
*EDC-38[e]	94.5 wt% HMX/3.5 wt% K-10 Liquid/2 wt% Polyurethane
HBX-1	40 wt% RDX/38 wt% TNT/17 wt% Al/5 wt% Wax/0.5 wt% $CaCl_2$

[a]EDC-8 is the United Kingdom's version of XTX-8003
[b]EDC-28 is the United Kingdom's version of PBX 9407
[c]EDC-32 is the United Kingdom's version of LX-04.
[d]For shipping, storage, and experimental evaluation of quantities less than 5 g and for assembly of finished charges into test devices only.
[e]For shipping, storage, and analytical evaluation of molding powder and assembly of finished pieces into test devices.

*Item added to Page.

APPROVALS:

Larry E Hatler — M-1 — 4-17-86 Date

M-DO — 5/13/86 Date

WX-3 — 5/9/86 Date

J C Courtright — HSE-3 — 5/21/86 Date

Table 1 (Cont)

Name or Code	Composition
High Energy Propellants[a]	Solid propellants generally used in missile systems
HMX	Cyclotetramethylenetetranitramine
HNS	Hexanitrostilbene
K-10[b]	65.3 wt% dinitroethylbenzene/34.7 wt% trinitroethylbenzene
LX-04	85 wt% HMX/15 wt% Viton A
LX-07	90 wt% HMX/10 wt% Viton A
LX-14	95.5 wt% HMX/4.5 wt% Estane 5702 F-1
Methane/oxygen[b]	Explosive mixtures of methane and oxygen gases
NC	Nitrocellulose, cellulose nitrate
Nitromethane	Nitromethane
NQ	Nitroguanidine
NTO*	1,2,4-nitro-triazole-5-one
Octol	75 wt% HMX/25 wt% TNT
PBX-9001	90 wt% RDX/8.5 wt% polystyrene/1.5 wt% dioctyl phthalate

*Item added.

[a]After approval by the Explosives Development Committee.
[b]For shipping, storage, and experimental evaluations on less than 5-g quantities.

Submitted: [signature] Date 5/1/87

APPROVALS:

[signature] M-1 5/1/87 DATE | [signature] WX-3 5/6/87 DATE

L A Gritzo M-DO 5/6/87 DATE | Jack L. Bacastow HSE-3 For W.C.C. 5/18/87 DATE

FJ 5/6

Table 1 (Cont)

Name or Code	Composition
PBX-9007	90 wt% RDX/9.1 wt% polystyrene/0.5 wt% dioctyl phthalate/0.4 wt% resin
PBX-9010	90 wt% RDX/10 wt% Kel-F 3700 elastomer
PBX-9011	90 wt% HMX/10 wt% Estane 5703 F-1
PBX-9205	92 wt% RDX/6 wt% polystyrene/2 wt% dioctyl phthalate
PBX-9206	92 wt% HMX/8 wt% Kel-F 3700 elastomer
PBX-9401	94.2 wt% RDX/3.6 wt% polystyrene/2.2 wt% trioctyl phosphate
PBX-9404	94 wt% HMX/3 wt% nitrocellulose/3 wt% chloroethyl phosphate
PBX-9405	94 wt% RDX/3 wt% nitrocellulose/3 wt% chloroethyl phosphate
PBX-9407	94 wt% RDX/6 wt% Exon 461
PBX-9501	95 wt% HMX/2.5 wt% Estane/2.5 wt% BDNPA/F
PBX-9502	95 wt% TATB/5 wt% Kel-F 800
PBX-9503	80 wt% TATB (Class 2)/15 wt% HMX (Class 2)/5 wt% Kel-F 800
PBXW-113	88 wt% HMX/12 wt% rubber/plasticizer binder

Table 1 (Cont)

Name or Code	Composition
Pentolite	50 wt% PETN/50 wt% TNT
PETN	Pentaerythritol tetranitrate
Picric Acid	Du Pont 85 wt% pure
*PYX	2,6-Bis(picrylamino)-3,5-dinitropyridine
RDX	Cyclonite, cyclotrimethylenetrinitramine
Smokeless Powder (Single Base)	Standard military grades. Single or multi-perforated grains of colloided nitrocellulose. Stabilizers, plasticizers, inorganic nitrates, and other modifying agents may also be present.
Smokeless Powder (Double Base)	Standard military grades. Single or multi-perforated grains of colloided nitrocellulose containing nitroglycerin or nitroglycol. Stabilizers, plasticizers, inorganic nitrates, and other modifying agents may also be present.
STRATABLAST C[a]	Slurry blasting explosive
TAGN[b]	Triaminoguanidine nitrate
TAL-1005E[a]	Slurry blasting explosive

*Item added to previous revision.
[a]For transportation only to and from M- and WX-Division Groups and storage by Group WX-3.
[b]For shipping, storage, and experimental evaluation on less than 5-g quantities.

Table 1 (Cont)

Name or Code	Composition
TATB	Triaminotrinitrobenzene
Tetryl	2,4,6-Trinitrophenylmethylnitramine
TNS	Trinitrostilbene
TNT	Trinitrotoluene
TNT/NC	80 wt% TNT/20 wt% NC
*TPM	Tripicrylmelamine
Tritonal	80 wt% TNT/20 wt% aluminum powder
XTX-8003	80 wt% Recrystallized PETN/20 wt% Sylgard 182
XTX-8004	80 wt% RDX/20 wt% Sylgard 182

*Item added to page.

APPROVALS:

J. E. Larson	6/22/87
M-1	Date
Original Signed by L. A. GRITZO	6/24/87
M-DO	Date
WX-3	Date
HSE-3	Date

TABLE 1

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Page 4, Page Revision 8	Page 8, Page Revision 0

Submitted: SE Hatler Date 3/10/86

Georgia T. Fritz Date 3/9/86

APPROVALS:

G. E. Larson 3/12/86
M-T Date

L A Gritzo 3/26/86
GJ 3/26 M-DO Date

W A May 3/28/86
WX-3 Date

N C Courtney 5/1/86
LTCI 4/26 HSE-3 Date

Wm. A. Bradley 3/28/86
WX-DO Date

TABLE 2

DEVELOPMENTAL EXPLOSIVES AT GROUP ~~GMX-3~~ WX-3*

The explosives listed in this table have been approved for development according to the procedures in "Group ~~GMX-3~~ WX-3 High Explosives Development Procedures and Authorization". Any limitations or special instructions relative to these explosives, other than those contained in the ~~GMX-3~~ WX-3 SOP's, will be found in the referenced High Explosives Development Proposal (HED). Any such limitations or instructions must be observed in addition to, and in the same manner as, those in the appropriate SOP's.

Experimental Code Number	Nominal Composition Weight Percent	Reference HED	Weight Limit
X-0001	86.1 HMX/13.9 Indowax 170/175	001	5 pounds
X-0002	89.2 HMX/10.8 Indowax 170/175	001	5 pounds
X-0003	92.1 HMX/7.9 Indowax 170/175	001	5 pounds
X-0004	94.9 HMX/5.1 Indowax 170/175	001	5 pounds
X-0005	97.5 HMX/2.5 Indowax 170/175	001	5 pounds
X-0006	82.6 HMX/17.4 Estane 5740X-2	001	5 pounds
X-0007	86.4 HMX/13.6 Estane 5740X-2	001	1500 pounds
X-0009	93.4 HMX/6.6 Estane 5740X-2	001	1500 pounds
X-0010	96.8 HMX/3.2 Estane 5740X-2	001	5 pounds
X-0011	82.6 HMX/17.4 CPR-1-46A	001	5 pounds
X-0012	86.4 HMX/13.6 CPR-1-46A	001	5 pounds
X-0013	90.0 HMX/10.0 CPR-1-46A	001	5 pounds
X-0014	93.4 HMX/6.6 CPR-1-46A	001	5 pounds
X-0015	96.8 HMX/3.2 CPR-1-46A	001	5 pounds
X-0016	82.6 HMX/17.4 CPR-1-46C	001	5 pounds
X-0017	86.4 HMX/13.6 CPR-1-46C	001	5 pounds
X-0018	90.0 HMX/10.0 CPR-1-46C	001	5 pounds
X-0019	93.4 HMX/6.6 CPR-1-46C	001	5 pounds
X-0020	96.8 HMX/3.2 CPR-1-46C	001	5 pounds

*Title changed from Page Revision 6

SUBMITTED		APPROVED		APPROVED	
	Date	M. L. BROOKS	10/12/62 Date	R. W. DRAKE	15 October 1962 Date

Table 2, continued)

Experimental Code Number	Nominal Composition * Weight Percent	Reference HED	Weight Limit
X-0021	78.3 HMX/21.7 Halowax 1001	001	5 pounds
X-0022	82.8 HMX/17.2 Halowax 1001	001	5 pounds
X-0023	87.2 HMX/12.8 Halowax 1001	001	5 pounds
X-0024	91.5 HMX/8.5 Halowax 1001	001	5 pounds
X-0025	95.8 HMX/4.2 Halowax 1001	001	5 pounds
X-0026	77.3 HMX/22.7 Halowax 1013	001	5 pounds
X-0027	82.0 HMX/18.0 Halowax 1013	001	5 pounds
X-0028	86.6 HMX/13.4 Halowax 1013	001	5 pounds
X-0029	91.1 HMX/8.9 Halowax 1013	001	5 pounds
X-0030	95.6 HMX/4.4 Halowax 1013	001	5 pounds
X-0031	76.2 HMX/23.8 Halowax 1014	001	5 pounds
X-0032	81.0 HMX/19.0 Halowax 1014	001	5 pounds
X-0033	85.8 HMX/14.2 Halowax 1014	001	5 pounds
X-0034	90.6 HMX/9.4 Halowax 1014	001	5 pounds
X-0035	95.3 HMX/4.7 Halowax 1014	001	5 pounds
X-0036	74.0 HMX/26.0 Halowax 1051	001	5 pounds
X-0037	79.2 HMX/20.8 Halowax 1051	001	5 pounds
X-0038	84.3 HMX/15.7 Halowax 1051	001	5 pounds
X-0039	89.5 HMX/10.5 Halowax 1051	001	5 pounds
X-0040	94.8 HMX/5.2 Halowax 1051	001	5 pounds
X-0041	86.0 HMX/14.0 Epolene LV	001	5 pounds
X-0042	89.1 HMX/10.9 Epolene LV	001	5 pounds
X-0043	92.1 HMX/7.9 Epolene LV	001	5 pounds
X-0044	94.9 HMX/5.1 Epolene LV	001	5 pounds
X-0045	97.5 HMX/2.5 Epolene LV	001	5 pounds

* Item changed from Page Revision 2

SUBMITTED:		APPROVED:		APPROVED:	
A. Popolato	3/30/66 Date	M. L. BROOKS	4/1/66 Date	R. W. DRAKE	4 April 1966 Date

(Table 2, continued)

Experimental Code Number	Nominal Composition * Weight Percent	Reference HED	Weight Limit
X-0046	85.9 HMX/14.1 Epolene HD	001	5 pounds
X-0047	89.0 HMX/11.0 Epolene HD	001	5 pounds
X-0048	92.0 HMX/8.0 Epolene HD	001	5 pounds
X-0049	94.8 HMX/5.2 Epolene HD	001	5 pounds
X-0050	97.5 HMX/2.5 Epolene HD	001	5 pounds
X-0051	77.6 HMX/22.4 Chlorowax 70	001	5 pounds
X-0052	82.2 HMX/17.8 Chlorowax 70	001	5 pounds
X-0053	86.7 HMX/13.3 Chlorowax 70	001	5 pounds
X-0054	91.2 HMX/8.8 Chlorowax 70	001	5 pounds
X-0055	95.6 HMX/4.4 Chlorowax 70	001	5 pounds
X-0056	73.0 HMX/27.0 Kel-F Wax 200	001	5 pounds
X-0057	78.3 HMX/21.7 Kel-F Wax 200	001	5 pounds
X-0058	83.6 HMX/16.4 Kel-F Wax 200	001	5 pounds
X-0059	89.0 HMX/11.0 Kel-F Wax 200	001	5 pounds
X-0060	94.5 HMX/5.5 Kel-F Wax 200	001	5 pounds
X-0061	75.5 HMX/24.5 Kel-F Elastomer L1107	001	5 pounds
X-0062	80.4 HMX/19.6 Kel-F Elastomer L1107	001	5 pounds
X-0063	85.3 HMX/14.7 Kel-F Elastomer L1107	001	5 pounds
X-0064	90.2 HMX/9.8 Kel-F Elastomer L1107	001	5 pounds
X-0065	95.1 HMX/4.9 Kel-F Elastomer L1107	001	5 pounds
X-0066	75.5 HMX/24.5 Kel-F Elastomer 3700	001	5 pounds
X-0067	80.4 HMX/19.6 Kel-F Elastomer 3700	001	5 pounds
X-0068	85.3 HMX/14.7 Kel-F Elastomer 3700	001	5 pounds
X-0069	90.2 HMX/9.8 Kel-F Elastomer 3700	001	5 pounds
X-0070	95.1 HMX/4.9 Kel-F Elastomer 3700	001	5 pounds

* Item changed from Page Revision 2

SUBMITTED:		APPROVED:		APPROVED:	
A Popolato	3/30/66	M. L. Brooks	4/1/66	R W Drake	4 Apr 1966
A. Popolato	Date	M. L. BROOKS	Date	R. W. DRAKE	Date

(Table 2, continued)

Experimental Code Number	Nominal Composition * Weight Percent	Reference HED	Weight Limit
X-0071	77.0 HMX/23.0 Exon 461	001	5 pounds
X-0072	81.7 HMX/18.3 Exon 461	001	5 pounds
X-0073	86.4 HMX/13.6 Exon 461	001	5 pounds
X-0074	91.0 HMX/9.0 Exon 461	001	5 pounds
X-0075	95.5 HMX/4.5 Exon 461	001	5 pounds
X-0076	85.6 RDX/14.4 Indowax 170/175	001	5 pounds
X-0077	88.7 RDX/11.3 Indowax 170/175	001	5 pounds
X-0078	91.7 RDX/8.3 Indowax 170/175	001	5 pounds
X-0079	94.6 RDX/5.4 Indowax 170/175	001	5 pounds
X-0080	97.4 RDX/2.6 Indowax 170/175	001	5 pounds
X-0081	81.9 RDX/18.1 Estane 5740X-2	001	5 pounds
X-0082	85.7 RDX/14.3 Estane 5740X-2	001	5 pounds
X-0083	89.5 RDX/10.5 Estane 5740X-2	001	5 pounds
X-0084	93.1 RDX/6.9 Estane 5740X-2	001	5 pounds
X-0085	96.6 RDX/3.4 Estane 5740X-2	001	5 pounds
X-0086	81.9 RDX/18.1 CPR-1-46A	001	5 pounds
X-0087	85.7 RDX/14.3 CPR-1-46A	001	5 pounds
X-0088	89.5 RDX/10.5 CPR-1-46A	001	5 pounds
X-0089	93.1 RDX/6.9 CPR-1-46A	001	5 pounds
X-0090	96.6 RDX/3.4 CPR-1-46A	001	5 pounds
X-0091	76.4 RDX/23.6 Halowax 1013	001	5 pounds
X-0092	81.2 RDX/18.8 Halowax 1013	001	5 pounds
X-0093	86.0 RDX/14.0 Halowax 1013	001	5 pounds
X-0094	90.7 RDX/9.3 Halowax 1013	001	5 pounds
X-0095	95.4 RDX/4.6 Halowax 1013	001	5 pounds

* Item changed from Page Revision 2

SUBMITTED:		APPROVED:		APPROVED:	
Popolato	3/30/66	M. L. Brooks	4/1/66	R. W. Drake	4 Apr 66
Popolato	Date	M. L. BROOKS	Date	R. W. DRAKE	Date

(Table 2, continued)

Experimental Code Number	Nominal Composition * Weight Percent	Reference HED	Weight Limit
X-0096	85.4 RDX/14.6 Epolene LV	001	5 pounds
X-0097	88.6 RDX/11.4 Epolene LV	001	5 pounds
X-0098	91.7 RDX/8.3 Epolene LV	001	5 pounds
X-0099	94.6 RDX/5.4 Epolene LV	001	5 pounds
X-0100	97.4 RDX/2.6 Epolene LV	001	5 pounds
X-0101	74.5 RDX/25.5 Kel-F 3700	001	5 pounds
X-0102	79.6 RDX/20.4 Kel-F 3700	001	5 pounds
X-0103	84.7 RDX/15.3 Kel-F 3700	001	5 pounds
X-0104	89.8 RDX/10.2 Kel-F 3700	001	5 pounds
X-0105	94.9 RDX/5.1 Kel-F 3700	001	5 pounds
X-0106	76.1 RDX/23.9 Exon 461	001	5 pounds
X-0107	80.9 RDX/19.1 Exon 461	001	5 pounds
X-0108	85.7 RDX/14.3 Exon 461	001	5 pounds
X-0109	90.5 RDX/9.5 Exon 461	001	5 pounds
X-0110	95.3 RDX/4.7 Exon 461	001	5 pounds
X-0111	94.8 HMX/0.0 NQ/5.2 Estane 5740X-2	002	5 pounds
X-0112	85.9 HMX/8.9 NQ/5.2 Estane 5740X-2	002	5 pounds
X-0113	76.7 HMX/18.0 NQ/5.3 Estane 5740X-2	002	400 pounds
X-0114	67.6 HMX/27.1 NQ/5.3 Estane 5740X-2	002	5 pounds
X-0115	58.3 HMX/36.4 NQ/5.3 Estane 5740X-2	002	5 pounds
X-0116	48.9 HMX/45.8 NQ/5.3 Estane 5740X-2	002	5 pounds
X-0117	39.3 HMX/55.3 NQ/5.4 Estane 5740X-2	002	5 pounds
X-0118	29.7 HMX/64.9 NQ/5.4 Estane 5740X-2	002	400 pounds
X-0119	19.9 HMX/74.6 NQ/5.5 Estane 5740X-2	002	5 pounds
X-0120	10.0 HMX/84.5 NQ/5.5 Estane 5740X-2	002	5 pounds

* Item changed from Page Revision 2

SUBMITTED:		APPROVED:		APPROVED:	
A. Popolato	3/30/66	M. L. BROOKS	4/1/66	R. W. DRAKE	4/4/1966
	Date		Date		Date

able 2, continued)

Experimental Code Number	Nominal Composition * Weight Percent	Reference HED	Weight Limit
X-0121	92.9 HMX/0.0 NQ/7.1 Halowax 1013	002	5 pounds
X-0122	84.1 HMX/8.8 NQ/7.1 Halowax 1013	002	5 pounds
X-0123	75.2 HMX/17.6 NQ/7.2 Halowax 1013	002	5 pounds
X-0124	66.2 HMX/26.6 NQ/7.2 Halowax 1013	002	5 pounds
X-0125	57.1 HMX/35.6 NQ/7.3 Halowax 1013	002	5 pounds
X-0126	47.9 HMX/44.8 NQ/7.3 Halowax 1013	002	5 pounds
X-0127	38.5 HMX/54.1 NQ/7.4 Halowax 1013	002	5 pounds
X-0128	29.1 HMX/63.5 NQ/7.4 Halowax 1013	002	5 pounds
X-0129	19.5 HMX/73.1 NQ/7.4 Halowax 1013	002	5 pounds
X-0130	9.8 HMX/82.7 NQ/7.5 Halowax 1013	002	5 pounds
X-0131	92.8 HMX/0.0 NQ/7.2 Exon 461	002	5 pounds
X-0132	84.0 HMX/8.7 NQ/7.3 Exon 461	002	5 pounds
-0133	75.1 HMX/17.6 NQ/7.3 Exon 461	002	5 pounds
X-0134	66.1 HMX/26.5 NQ/7.4 Exon 461	002	5 pounds
X-0135	57.0 HMX/35.6 NQ/7.4 Exon 461	002	5 pounds
X-0136	47.8 HMX/44.8 NQ/7.4 Exon 461	002	5 pounds
X-0137	38.5 HMX/54.0 NQ/7.5 Exon 461	002	5 pounds
X-0138	29.0 HMX/63.5 NQ/7.5 Exon 461	002	5 pounds
X-0139	19.5 HMX/72.9 NQ/7.6 Exon 461	002	5 pounds
X-0140	9.8 HMX/82.6 NQ/7.6 Exon 461	002	5 pounds
X-0142	90.2 HMX/4.6 DATB/5.2 Estane 5740X-2	004	5 pounds
X-0143	85.6 HMX/9.2 DATB/5.2 Estane 5740X-2	004	400 pounds
X-0144	76.3 HMX/18.5 DATB/5.2 Estane 5740X-2	004	400 pounds
X-0145	67.0 HMX/27.8 DATB/5.2 Estane 5740X-2	004	400 pounds

Item changed from Page Revision 7

SUBMITTED:		APPROVED:		APPROVED:	
L. Popolato	3/30/66 Date	M. L. BROOKS	4/1/66 Date	R. W. DRAKE	4 April 1966 Date

(Table 2, continued)

Experimental Code Number	Nominal Composition * Weight Percent	Reference HED	Weight Limit
X-0146	57.7 HMX/37.1 DATB/5.2 Estane 5740X-2	004	400 pounds
X-0147	48.2 HMX/46.5 DATB/5.3 Estane 5740X-2	004	400 pounds
X-0148	38.6 HMX/56.1 DATB/5.3 Estane 5740X-2	004	5 pounds
X-0149	29.1 HMX/65.6 DATB/5.3 Estane 5740X-2	004	5 pounds
X-0150	19.5 HMX/75.2 DATB/5.3 Estane 5740X-2	004	5 pounds
X-0151	9.7 HMX/84.9 DATB/5.4 Estane 5740X-2	004	5 pounds
X-0152	4.9 HMX/89.7 DATB/5.4 Estane 5740X-2	004	5 pounds
X-0154	88.4 HMX/4.5 DATB/7.1 Halowax 1013	004	5 pounds
X-0155	83.9 HMX/9.0 DATB/7.1 Halowax 1013	004	5 pounds
X-0156	74.8 HMX/18.1 DATB/7.1 Halowax 1013	004	5 pounds
X-0157	65.6 HMX/27.2 DATB/7.2 Halowax 1013	004	5 pounds
X-0158	56.4 HMX/36.4 DATB/7.2 Halowax 1013	004	5 pounds
X-0159	47.2 HMX/45.6 DATB/7.2 Halowax 1013	004	5 pounds
X-0160	37.9 HMX/54.9 DATB/7.2 Halowax 1013	004	5 pounds
X-0161	28.5 HMX/64.2 DATB/7.3 Halowax 1013	004	5 pounds
X-0162	19.0 HMX/73.7 DATB/7.3 Halowax 1013	004	5 pounds
X-0163	9.6 HMX/83.1 DATB/7.3 Halowax 1013	004	5 pounds
X-0164	4.8 HMX/87.9 DATB/7.3 Halowax 1013	004	5 pounds
X-0165	92.2 HMX/0.0 DATB/7.8 KFE 3700	004	5 pounds
X-0166	87.7 HMX/4.5 DATB/7.8 KFE 3700	004	5 pounds
X-0167	83.3 HMX/8.9 DATB/7.8 KFE 3700	004	5 pounds
X-0168	74.2 HMX/17.9 DATB/7.9 KFE 3700	004	5 pounds
X-0169	65.1 HMX/27.0 DATB/7.9 KFE 3700	004	400 pounds
X-0170	56.0 HMX/36.1 DATB/7.9 KFE 3700	004	5 pounds

* Item changed from Page Revision 0

SUBMITTED:		APPROVED:		APPROVED:	
A Popolato	3/30/..	M. L. Brooks	4/1/66	R W Drake	4 April 66
A. Popolato	Date	M. L. BROOKS	Date	R. W. DRAKE	Date

(Table 2, continued)

Experimental Code Number	Nominal Composition * Weight Percent	Reference HED	Weight Limit
X-0171	46.8 HMX/45.3 DATB/7.9 KFE 3700	004	5 pounds
X-0172	37.6 HMX/54.5 DATB/7.9 KFE 3700	004	5 pounds
X-0173	28.3 HMX/63.7 DATB/8.0 KFE 3700	004	400 pounds
X-0174	18.9 HMX/73.1 DATB/8.0 KFE 3700	004	5 pounds
X-0175	9.5 HMX/82.5 DATB/8.0 KFE 3700	004	5 pounds
X-0176	4.8 HMX/87.2 DATB/8.0 KFE 3700	004	5 pounds
X-0177	99.7 75/25 Cyclotol/0.3 α-nitronaphthalene	003	40 pounds
X-0178	99.6 75/25 Cyclotol/0.4 α-nitronaphthalene	003	40 pounds
X-0179	99.5 75/25 Cyclotol/0.5 α-nitronaphthalene	003	40 pounds
X-0180	92.2 HMX/0.0 NQ/7.8 KFE 3700	002	5 pounds
X-0181	83.5 HMX/8.7 NQ/7.8 KFE 3700	002	5 pounds
X-0182	74.6 HMX/17.5 NQ/7.9 KFE 3700	002	5 pounds
X-0183	65.7 HMX/26.4 NQ/7.9 KFE 3700	002	400 pounds
X-0184	56.6 HMX/35.4 NQ/8.0 KFE 3700	002	5 pounds
X-0185	47.5 HMX/44.5 NQ/8.0 KFE 3700	002	5 pounds
X-0186	38.2 HMX/53.7 NQ/8.1 KFE 3700	002	5 pounds
X-0187	28.8 HMX/63.1 NQ/8.1 KFE 3700	002	5 pounds
X-0188	19.3 HMX/72.5 NQ/8.2 KFE 3700	002	5 pounds
X-0189	9.7 HMX/82.1 NQ/8.2 KFE 3700	002	5 pounds
X-0190	89.11 RDX/9.9 KFE 3700/0.99 Beeswax w/Alox	006	300 pounds
X-0191	93.07 HMX/2.97 NC/2.9 CEF/0.99 Beeswax w/Alox	006	500 pounds
X-0192	85.0 HMX/15.0 Viton	007	1000 pounds

* Item changed from Page Revision 1

SUBMITTED:		APPROVED:		APPROVED:	
A. Popolato	3/30/66	M. L. BROOKS	4/1/66	R. W. DRAKE	4 April 1966
	Date		Date		Date

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent	Reference HED	Weight Limit
X-0193	Experimental detonating fuse explosives Compositions range from 73.1 HMX/26.9 Sylgard 182 to 98.9 HMX/1.1 Sylgard 182	008	See footnote
X-0194	Experimental detonating fuse explosives Compositions range from 70 PETN/30 Sylgard 182 to 80 PETN/20 Sylgard 182	008 Phase 3, Addendum 2	20 pounds
* X-0195	55.9 HMX/36.1 DATB/8.0 Estane	004	400 pounds
* X-0196	56.8 HMX/36.6 DATB/6.6 Estane	004	400 pounds
X-0197	88.7 HMX/11.3 Teflon	001	5 pounds
X-0198	67.1 HMX/32.9 Teflon	001	5 pounds
X-0199	88.7 HMX/10.3 Teflon w/wax and Alox	001	5 pounds
X-0200	67.4 HMX/32.6 Teflon w/wax and Alox	001	5 pounds
X-0201	60 TNT/40 RDX	009	200 pounds
X-0202	40 Barium Nitrate/60 TNT	005	800 pounds
X-0204	83.2 HMX/16.8 Teflon	001, Addendum 8	1000 pounds
X-0205	84.2 HMX/15.8 Teflon w/wax and Alox	001, Addendum 8	1000 pounds
X-0206	84.2 HMX/15.8 Nitroso elastomer	011	150 pounds
X-0207	80 HMX/20 Sylgard 182	008	500 pounds
X-0208	80 RDX/20 Sylgard 182	008	500 pounds
X-0209	95.5 HMX/2.5 Elvax 460/2.5 Be-Square 170/175 wax	012	1000 pounds

Footnote: Weight limit for any given composition is 500 grams. Within this limit, material may be replaced as cross-linked batches and are sent for disposal.

* Item changed from Page Revision 3

SUBMITTED:	SUBMITTED:	SUBMITTED:
H L Flaugh 10-12-71	A Popolato 10/12/71	
L. Flaugh DATE	A. Popolato DATE	DATE
APPROVED:	APPROVED:	APPROVED:
R West 10-19-71	R W Drake 21 October 1971	Roy Reider 21 Oct 71
C. R. WEST DATE	R. W. DRAKE DATE	R. REIDER DATE

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0210	94.1 HMX/2.95 Estane/2.95 BDNPF		013	1000 pounds
X-0211	LX-07 - 90 HMX/10 Viton A		014	500 pounds
X-0212	90 HMX/10 CPR X9B-78B		015	1000 pounds
X-0213	94.6 HMX/2.0 Estane/2.0 BDNPF/1.4 Be-Square 170/175 wax		016	1000 pounds
X-0214	90 HMX/10 Viton A		017	1000 pounds
X-0215	90.0 HMX/8.5 Viton A/1.5 Beeswax		017	1000 pounds
X-0217	HMX	25 - 94	019	See HED-019, V.C.
	DNPA	0 - 50		
	BDNPF	0 - 50		
	BDNPA	0 - 50		
	Wax	0 - 5		
	Surface Active Agents	0 - 0.25		
X-0218	HMX	90 - 95	020	1000 pounds
	Halowax 1014	0 - 10		
	Hydrocarbon Waxes	0 - 5		
	Alox	0 - 2		
	Estane	0 - 2		
	Surface Active Agents	0 - 1		
X-0219	TATB	0 - 92	021	See HED-021, III.C.
	HMX	0 - 92		
	Kel-F	9 - 15		
X-0220	DATB	40 - 60	022	*See HED-022, V.D.
	Urea-formaldehyde Microballoons	20 - 40		
	Epoxy resin/chlorendic anhydride	10 - 30		
X-0221	RDX	40 - 60	022	*See HED-022, V.D.
	Urea-formaldehyde Microballoons	20 - 40		
	Epoxy resin/chlorendic anhydride	10 - 30		

* Item changed from Page Revision 0

SUBMITTED:	Date	APPROVED:	Date	APPROVED:	Date
A. Popolato	12/1/66	M. L. BROOKS	12/2/66	R. W. DRAKE	12 December 1966

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0222	DATB	30 - 60	022	See HED-022, V.D.
	Phenol-formaldehyde Microballoons	20 - 50		
	Epoxy resin/chlorendic anhydride	10 - 30		
X-0223	RDX	30 - 60	022	See HED-022, V.D.
	Phenol-formaldehyde Microballoons	20 - 50		
	Epoxy resin/chlorendic anhydride	10 - 30		
X-0224	RDX	74.0	023	4000 pounds - uncoated
	Aluminum	20.0		*2000 pounds - coated
	Be-Square 170/175 wax	5.4		
	Elvax 460	0.6		
	*Coating compounds	0 - 0.5		
X-0225	HMX	94.0	024	1000 pounds
	DNPA	3.5		
	FEFO	2.5		
X-0226	RDX	80 - 90	001	See HED-001, Addendum 9, VI.C.
	Estane	20 - 10		
EDC-8	PETN	76.0	025	See HED-025, IV.E.
	RTV Silicone	24.0		
X-0227	Nitroguanidine	70 - 100	026	1000 pounds
	Kel-F elastomer	0 - 30		
X-0228	Nitroguanidine	70 - 100	026	1000 pounds
	Estane 5703	0 - 30		
X-0229	Nitroguanidine	70 - 100	026	1000 pounds
	DNPA polymer	0 - 18		
	BDNPF/A nitroplasticizer	0 - 12		

* Item added to Page Revision 5

SUBMITTED:		APPROVED:		APPROVED:	
A. Popolato	6/15/70	M. L. BROOKS	6/19/70	R. W. DRAKE	24 June 1970
	Date		Date		Date

able 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0230	RDX	94	023	See HED-023 Addendum 1, V.C.
	Be-Square 170/175 wax - Elvax 460	6		
X-0231	HMX	5 - 40	027	See HED-027 VI. D.
	Tungsten	40 - 95		
	Exon 461	0 - 10		
	Plasticizer	0 - 5		
X-0232	HMX	5 - 40	027	See HED-027 VI. D.
	Tungsten	40 - 95		
	Kel-F	0 - 10		
	Plasticizer	0 - 5		
X-0233	HMX	5 - 40	027	See HED-027 VI. D.
	Tungsten	40 - 95		
	Polystyrene	0 - 10		
	Plasticizer	0 - 5		
X-0234	HMX	90 - 95	019	See HED-019 VI. D.
	DNPA	0 - 10		
	CEF	0 - 5		
	Surface-active agents	0 - 0.5		
X-0235	HMX	90 - 95	019	See HED-019 VI. D.
	DNPA	0 - 10		
	BDNPF-BDNPA eutectic	0 - 10		
	Estane	0 - 5		
	Surface-active agents	0 - 0.5		
*X-0236	TATB	≤ 95	028	See HED-028 V. D.
	Polystyrene/DOP	≥ 5		
	Surface-active agents	≤ 1		
*X-0237	TATB	≤ 95	028	See HED-028 V. D.
	Wax/Elvax	≥ 5		
	Surface-active agents	≤ 1		

* Item added to Page Revision 2

SUBMITTED:		APPROVED:		APPROVED:	
A. Popolato	1/2/69 Date	M. L. BROOKS	1/3/69 Date	R. W. DRAKE	9 January 1969 Date

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0238	TATB	≤ 95	028	See HED-028 V.D.
	Estane	≥ 5		
	Surface Active Agents	≥ 1		
X-0239	HMX	5 - 40	027	See HED-027 VI.D.
	Tungsten	40 - 95		
	Estane	0 - 10		
	Plasticizer	0 - 5		
X-0240	HMX	95	029	See HED-029 IV.
	Viton	5		
X-0241	Nitroguanidine	90 - 100	026	1000 pounds
	Wax/Elvax	0 - 10	Addendum 1	
*X-0242	HMX	90 - 95	013	5000 pounds
	BDNPF-A	0 - 5	Addendum 2	
	Estane	0 - 5		
	Calcium Stearate	0 - 0.5		
X-0243	DATB	≤ 95	028	500 pounds
	Polystyrene/DOP	≥ 5	Addendum 1	
X-0244	DATB	≤ 95	028	500 pounds
	Polystyrene/TOF	≥ 5	Addendum 1	
X-0245	DATB	≤ 95	028	500 pounds
	Wax/Elvax	≥ 5	Addendum 1	
X-0246	DATB	≤ 95	028	500 pounds
	Estane	≥ 5	Addendum 1	
X-0247	DATB	≤ 95	028	500 pounds
	Kel-F	≥ 5	Addendum 1	

* Item changed from Page Revision 5

SUBMITTED:		SUBMITTED:		SUBMITTED:	
W. Salgado	3/9/72	A. Popolato	3/9/72		
W. Salgado	DATE	A. Popolato	DATE		DATE
APPROVED:		APPROVED:		APPROVED:	
R. West	3/13/72	R. W. Drake	17 Mar 1972	R. Reider	17 Mar 1972
R. WEST	DATE	R. W. DRAKE	DATE	R. REIDER	DATE

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0248	DATB DNPA/BDNPA-F	≤ 95 ≥ 5	028 Addendum 1	500 pounds
X-0249	RDX Sylgard 182 Barium carbonate	≤ 42.9 (50 v/o) 0-40 0-70	008 Addendum 1	5 pounds
X-0250	RDX Sylgard 182 Cyanuric acid	≤ 57.5 (50 v/o) 0-40 0-70	008 Addendum 1	5 pounds
X-0251	DATB Sylgard 182 Barium carbonate	≤ 42.6 (50 v/o) 0-40 0-70	008 Addendum 1	5 pounds
X-0252	DATB Sylgard 182 Cyanuric acid	≤ 57.1 (50 v/o) 0-40 0-70	008 Addendum 1	5 pounds
X-0253	TATB Dapon M	< 95 < 5	028 Addendum 2	500 pounds
* X-0254	RDX Estane $BaCO_3$	≤ 47.3 ≥ 6.3	HED-030	5 pounds
* X-0255	RDX Estane Oxamide	≤ 66.5 ≥ 8.9 ≥ 24.6	HED-030	5 pounds
* X-0256	RDX Viton $BaCO_3$	≤ 45.7 ≥ 9.4 ≥ 44.9	HED-030	5 pounds

* Item added to Page Revision 1

SUBMITTED: H. L. Flaugh 10-29-71 . Flaugh DATE	SUBMITTED: P. G. Salgado 10/29/71 P. G. Salgado DATE	SUBMITTED: A. Popolato 11/15/71 A. Popolato DATE
ROVED: C. R. West 11-18-71 C. R. WEST DATE	APPROVED: R. W. Drake 6 December 1971 R. W. DRAKE DATE	APPROVED: R. Reider 12-6-71 R. REIDER DATE

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0257	RDX	≤63.5	HED-030	5 pounds
	Viton	≥13.0		
	Oxamide	≥23.5		
X-0258	RDX	≤47.7	HED-030	5 pounds
	Polystyrene	≥ 4.1		
	DOP	≥ 1.4		
	$BaCO_3$	≥46.8		
X-0259	RDX	≤67.4	HED-030	5 pounds
	Polystyrene	≥ 5.8		
	DOP	≥ 1.9		
	Oxamide	≥24.9		
X-0260	RDX	≤47.9	HED-030	5 pounds
	Wax	≥ 2.5		
	Elvax	≥ 2.5		
	$BaCO_3$	≥47.1		
X-0261	RDX	≤67.9	HED-030	5 pounds
	Wax	≥ 3.6		
	Elvax	≥ 3.5		
	Oxamide	≥25.0		
X-0262	DATB	≤47.0	HED-030	5 pounds
	Estane	≥ 6.3		
	$BaCO_3$	≥46.7		
X-0263	DATB	≤66.3	HED-030	5 pounds
	Estane	≥ 8.9		
	Oxamide	≥ 24.8		
X-0264	DATB	≤45.4	HED-030	5 pounds
	Viton	≥ 9.4		
	$BaCO_3$	≥45.2		

SUBMITTED:		SUBMITTED:		SUBMITTED:	
Popolato	11/1/71	P. G. Salgado	10/27/71	H. L. Flaugh	10-29-71
(Popolato)	DATE	P. G. Salgado	DATE	H. L. Flaugh	DATE
APPROVED:		APPROVED:		APPROVED:	
R West	11-18-71	R W Drake	6 December 1971	R Reider	12-6-71
R. WEST	DATE	R. W. DRAKE	DATE	R. REIDER	DATE

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0265	DATB	≤63.2	HED-030	5 pounds
	Viton	≥13.1		
	Oxamide	≥23.7		
X-0266	DATB	≤47.4	HED-030	5 pounds
	Polystyrene	≥ 4.1		
	DOP	≥ 1.4		
	$BaCO_3$	≥47.1		
X-0267	DATB	≤67.1	HED-030	5 pounds
	Polystyrene	≥ 5.8		
	DOP	≥ 2.0		
	Oxamide	≥25.1		
X-0268	DATB	≤47.6	HED-030	5 pounds
	Wax	≥ 2.5		
	Elvax	≥ 2.5		
	$BaCO_3$	≥27.4		
X-0269	DATB	≤67.6	HED-030	5 pounds
	Wax	≥ 3.6		
	Elvax	≥ 3.5		
	Oxamide	≥25.3		
X-0270	RDX	50-85	HED-022	200 pounds
	Exon	15-50	Addendum 3	
* X-0271	Barium Nitrate	~76.0	HED-031	2000 pounds
	TNT	~24.0		
	Decylgallophenone or Nitrocellulose	~ 0.5		

* Item added to Page Revision 1

SUBMITTED:	SUBMITTED:	SUBMITTED:
[signature] for [signature] 3/28/72	[signature] 3/28/72	
[illegible]polato DATE	P. G. Salgado DATE	DATE
APPROVED:	APPROVED:	APPROVED:
[signature] 4/3/72	[signature] 12 April 72	[signature] 13 Apr 72
[illegible] R. WEST DATE	R. W. DRAKE DATE	R. REIDER DATE

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0272	HMX	≤95	HED-013	500 pounds
	TATB	0 - 10	Addendum 3	
	Estane	0 - 5		
	Calcium Stearate	0 - 0.5		
X-0273	HMX	≤92	HED-021	500 pounds
	DATB	≤92	Addendum 1	
	Kel-F	8 - 15		
X-0274	RDX	0 - 60	HED-032	1000 pounds
	TNT	35 - 100	Addendum 1	
	AN (NH_4NO_3)	0 - 70		
	Compatible surface active agent	0 - 2		
*X-0275	TATB	40	HED-033	50 kg
	TNT	40		
	Aluminum	20		
*X-0276	RDX	59.5	HED-023	50 kg
	Cu	35.9	Addendum 3	
	B^2 wax	4.1		
	Elvax	0.5		
*X-0277	RDX	62.2	HED-023	50 kg
	Fe	33.0	Addendum 3	
	B^2 wax	4.3		
	Elvax 460	0.5		
*X-0278	RDX	42.2	HED-023	50 kg
	$Ba(NO_3)_2$	52.9	Addendum 3	
	B^2 wax	4.4		
	Elvax	0.5		
*X-0279	RDX	54.1	HED-023	50 kg
	$CsNO_3$	40.8	Addendum 3	
	B^2 wax	4.6		
	Elvax	0.5		

*Items changed from Page Revision 3

TED: A Popolato 4/5/74 A. Popolato DATE	SUBMITTED: H L Flaugh 4-5-74 H. L. Flaugh DATE	SUBMITTED: DATE
PROVED: C R West 4/8/74 C. R. WEST DATE	APPROVED: R W Drake 12 April 1974 R. W. DRAKE DATE	APPROVED: R Reider 12 April 74 R. REIDER DATE

(Table 2, continued)

rimental [..]de Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0280	RDX Estane	95.0 5.0	HED-013 Addendum 5	250 kg
X-0281	RDX Estane BDNPA/F	95.0 2.5 2.5	HED-013 Addendum 5	250 kg
X-0282	HMX Estane	95.5 4.5	HED-034 Phase 3	500 kg
X-0283	HMX Viton Kel-F elastomer Various plasticizers	≤95.0 2.5 to 10.0 2.5 to 10.0 2.5 to 5.0	HED-029 Phase 3 Addendum 1	500 kg
X-0284	RDX TNT AN (KNO_3) Compatible surface active agents	0 to 60 35 to 100 0 to 70 0 to 2	HED-032 Phase 3 Addendum 2	500 kg
X-0285	HMX Vibrathane	95.5 4.5	HED-034 Phase 3 Addendum 1	500 kg
X-0286	HMX Kraton High-vacuum oil plasticizer	97 ± 0.5 1.35 1.65	HED-035 Phase 3	250 kg
*X-0287	HMX Kraton B² Wax	97.4 ± 0.5 1.43 1.17	HED-035 Phase 3 Addendum 1	250 kg
*X-0288	HMX Fluorolube MO-10 Cab-O-Sil	≤75.0 ≥22.0 ≤ 3.0	HED-008 Phase 2 Addendum 2	5 kg

*Item added to Page Revision 5

SUBMITTED:	DATE	SUBMITTED:	DATE	SUBMITTED:	DATE
[signature] A. Popolato	1-3-75	[signature] H. L. Flaugh	1-3-75		
APPROVED:		APPROVED:		APPROVED:	
[signature] C. R. WEST	1-8-75	[signature] R. W. DRAKE	20 January 1975	[signature] R. REIDER	20 Jan 75

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0289	HMX Fluorolube LG-260 Cab-O-Sil	≤75.0 ≥22.0 ≤ 3.0	HED-008 Phase 2 Addendum 2	5 kg
*X-0290	TATB Kel-F 800	95 5	HED-021 Phase 3 Addendum 7	2000 kg
X-0291	TATB Kel-F 800	92.5 7.5	HED-021 Phase 3 Addendum 5	500 kg
X-0292	TATB Vibrathanes	92 → 98 2 → 8	HED-021 Phase 3 Addendum 5	500 kg
X-0293	RDX AN	40 ± 2 60 ± 2	HED-036 Phase 3	45.4 kg
X-0294	RDX AN MAN	40 ± 2 45 ± 2 15 ± 2	HED-036 Phase 3	45.4 kg
X-0295	RDX AN MAN	40 ± 2 30 ± 2 30 ± 2	HED-036 Phase 3	45.4 kg
X-0296	TATB Kraton	90 → 99 10 → 1	HED-021 Phase 3 Addendum 5	500 kg
X-0297	TATB Kel-F 800	97.5 2.5	HED-021 Phase 3 Addendum 5	500 kg
X-0298	HMX Kraton Hyvac oil 930503	97.5 1.12 1.38	HED-035 Phase 3 Addendum 2	250 kg

*Item changed from Page Revision 5

SUBMITTED: H. L. Flaugh 8-12-76 H. L. Flaugh DATE	SUBMITTED: A. Popolato 8/12/76 A. Popolato DATE	SUBMITTED: DATE
APPROVED: H. B. Fletcher 8-16-76 H. B. FLETCHER DATE	APPROVED: 23 Aug 1976 R. W. DRAKE DATE	APPROVED: R. Reider 24 Aug R. REIDER DATE

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0299	DATB Viton A	95 ± 2 5 ± 2	HED-004 Phase 3 Addendum 5	25 kg
X-0300	DATB Estane	95 ± 2 5 ± 2	HED-004 Phase 3 Addendum 5	25 kg
X-0301	RDX Viton A	95 5	HED-029 Phase 3 Addendum 2	100 kg
X-0302	FKM		HED-040 Phase 2	5 kg
*X-0303	RDX Estane Polyester fibers	95.0 4.5 0.5	HED-013 Phase 3 Addendum 7, Rev 1	2000 kg
*X-0304	RDX Estane Polyester fibers	95.0 3.5 1.5	HED-013 Phase 3 Addendum 7, Rev. 1	2000 kg
X-0305	TATB Kel-F 800 Fluorolube plasticizer	95.0 2.5 2.5	HED-021 Phase 3 Addendum 5	2000 kg
X-0306	Nitroguanidine Viton A	95.0 5.0	HED-026 Phase 3 Addendum 3	500 kg
X-0307	Nitroguanidine Viton A Fluorolube plasticizer	95.0 4.0 1.0	HED-026 Phase 3 Addendum 3	500 kg
**X-0308	RDX Estane Polyethylene fibers	95.0 4.5 0.5	HED-013 Phase 3 Addendum 7, Rev. 1	2000 kg

*Item changed from Page Revision 5
**Item added to Page Revision 5

ED: [signature] 10-12-76 ...URG DATE	SUBMITTED: A Popolato 10/12/76 A. Popolato DATE	SUBMITTED:
D: [signature] 10-14-76 FLETCHER DATE	APPROVED: for R. W. Drake 11/3/76 R. W. DRAKE DATE	APPROVED: R Reider R. REIDER

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0309 (Destex)	TNT Aluminum D-2 Acetylene black (carbon)	74.6 18.7 4.8 1.9	HED-041 Phase 3	500 kg
X-0310	NQ Viton LM	95.0 5.0	HED-026 Phase 3 Addendum 4	100 kg
X-0311	NQ Viton 10	95.0 5.0	HED-026 Phase 3 Addendum 4	100 kg
X-0312	RDX Estane Polyethylene fibers	95.0 3.5 1.5	HED-013 Phase 3 Addendum 7 Revision 1	100 kg
X-0313	NQ Viton A-HV	95.0 5.0	HED-026 Phase 3 Addendum 4	100 kg
X-0314	NQ Viton C-10	95.0 5.0	HED-026 Phase 3 Addendum 4	100 kg
X-0315	NQ Viton L-31	95.0 5.0	HED-026 Phase 3 Addendum 4	100 kg
X-0316	NQ RDX Viton A	91.0 4.0 5.0	HED-026 Phase 3 Addendum 5	1 kg
X-0317	NQ RDX Viton A	87.0 8.0 5.0	HED-026 Phase 3 Addendum 5	1 kg
*X-0318	HNS Sylgard 182	80.0 20.0	HED-038 Phase 2	0.1 kg

*Item added to Page Revision 4

SUBMITTED:		SUBMITTED:		SUBMITTED:	
A. Popolato	1/3/78 DATE	H. L. Flaugh	1-3-77 DATE		DATE
APPROVED:		APPROVED:		APPROVED:	
R. J. Daly R. J. DALY	1/6/78 DATE	R. W. DRAKE	13 January 1978 DATE	L. A. Blackwell	1/16/78 DATE

9n

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0319	TATB HMX Kel-F 800	50.0 45.0 5.0	HED-021 Phase 3 Addendum 10	100 kg
X-0320	TATB HMX Kel-F 800	60.0 35.0 5.0	HED-021 Phase 3 Addendum 10	100 kg
X-0321	TATB HMX Kel-F 800	75.0 20.0 5.0	HED-021 Phase 3 Addendum 10	100 kg
X-0322	Fairy Dust 2/1		HED-042 Phase 2	1 kg
*X-0323	NQ Kraton G/Hyvac oil	95.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
*X-0324	NQ HMX Viton A	50.0 45.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
*X-0325	NQ HMX Viton A	60.0 35.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
*X-0326	NQ HMX Viton A	75.0 20.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
*X-0327	NQ HMX Kraton G/Hyvac oil	50.0 45.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
*X-0328	NQ HMX Kraton G/Hyvac oil	60.0 35.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
X-0329	TATB Phenoxy	96.9 3.1	HED-021 Phase 3 Addendum 5	227 kg

*Item added to Page Revision 2

ED: [signature] A. P. Torres — DATE 8-15-78	SUBMITTED: A Popolato — A. Popolato — DATE 8/16/78	SUBMITTED: ______ DATE
OVED: R J. Daly — R. J. DALY — DATE 8/23/78	APPROVED: for R W Drake — R. W. DRAKE — DATE 8/30/78	APPROVED: L A Blackwell — L. A. BLACKWELL — DATE 9/11/78

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0330	TATB Polystyrene/polyphenylene-oxide	97.2 2.8	HED-021 Phase 3 Addendum 5	227 kg
X-0331	TATB Kel-F 800	99.5 0.5	HED-021 Phase 3 Addendum 5	227 kg
X-0332	TATB Kel-F 800	99.0 1.0	HED-021 Phase 3 Addendum 5	227 kg
X-0333	TATB Kel-F 800	98.0 2.0	HED-021 Phase 3 Addendum 5	227 kg
X-0334	NQ HMX Kraton G/Hyvac oil	75.0 20.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
X-0335	NQ HMX Kraton G/Hyvac oil	45.0 45.0 10.0	HED-026 Phase 3 Addendum 6	100 kg
X-0336	NQ Polyvinyl alcohol	95.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
X-0337	NQ Kel-F 800	95.0 5.0	HED-026 Phase 3 Addendum 6	100 kg
X-0338	NQ Viton A	99.5 0.5	HED-026 Phase 3 Addendum 6	100 kg
*X-0339	TATB Kel-F 800 Polyethylene fibers	95.0 4.5 0.5	HED-021 Phase 3 Addendum 5	90.8 kg

*Item added to Page Revision 1

...TED:	11/13/78	SUBMITTED: A Popolato	11/3/78	SUBMITTED:	
A. P. Torres	DATE	A. Popolato	DATE		DATE
APPROVED: R J Daly	11/15/78	APPROVED: R W Drake	11/15/78	APPROVED: L A Blackwell	11/21/7?
R. J. DALY	DATE	R. W. DRAKE	DATE	L. A. BLACKWELL	DATE

(Table 2, continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0340	NO Nylon	95.0 5.0	HED-026 Phase 3 Addendum 4	3 kg
X-0341	TATB HMX Kel-F 800	90.25 4.75 5.0	HED-021 Phase 3 Addendum 10	100 kg
X-0342	TATB HMX Kel-F 800	85.5 9.5 5.0	HED-021 Phase 3 Addendum 10	100 kg
X-0343	TATB HMX Kel-F 800	80.75 14.25 5.0	HED-021 Phase 3 Addendum 10	100 kg
X-0344	TATB HMX Kel-F 800	71.25 23.75 5.0	HED-021 Phase 3 Addendum 10	90.8 kg
X-0345	TATB Kraton G Hyvac oil	97.6 1.68 0.72	HED-021 Phase 3 Addendum 5	90.8 kg
X-0346	Nitromethane	100.0	HED-043 Phase 2	5.0 lb
X-0347	Nitromethane Aluminum powder	80.0 20.0	HED-043 Phase 2	5.0 lb
X-0348	Nitromethane Aluminum powder Polymethyl methacrylate	75.0 20.0 5.0	HED-043 Phase 2	5.0 lb
*X-0349	TATB, Superfine HMX Kel-F 800	90.0 5.0 5.0	HED-021 Phase 3 Addendum 10	90.8 kg
*X-0350	TATB, Superfine HMX Kel-F 800	85.0 10.0 5.0	HED-021 Phase 3 Addendum 10	90.8 kg

*Item added to Page Revision 3

TYPED: P. Torres — DATE 4/20/79	SUBMITTED: H. L. Flauch — DATE 5-9-79	SUBMITTED: — DATE
APPROVED: R. J. DALY — DATE 5/21/79	APPROVED: R. W. DRAKE — DATE	APPROVED: L. A. BLACKWELL — DATE

Table 2 (continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0351	TATB, Superfine	80.0	HED-021	90.8 kg
	HMX	15.0	Phase 3	
	Kel-F 800	5.0	Addendum 10	
X-0352	TATB, Superfine	75.0	HED-021	90.8 kg
	HMX	20.0	Phase 3	
	Kel-F 800	5.0	Addendum 10	
X-0353	TATB, Superfine	92.5	HED-021	100 kg
	HMX	5.0	Phase 3	
	Kel-F 800	2.5	Addendum 11	
X-0354	TATB, Superfine	87.5	HED-021	100 kg
	HMX	10.0	Phase 3	
	Kel-F 800	2.5	Addendum 11	
X-0355	TATB, Superfine	82.5	HED-021	100 kg
	HMX	15.0	Phase 3	
	Kel-F 800	2.5	Addendum 11	
X-0356	TATB, Superfine	77.5	HED-021	100 kg
	HMX	20.0	Phase 3	
	Kel-F 800	2.5	Addendum 11	
X-0357	TATB, Superfine	82.5	HED-021	90.8 kg
	HMX	12.5	Phase 3	
	Kel-F 800	5.0	Addendum 10	
X-0358	TATB, Superfine	85.0	HED-021	100 kg
	HMX	12.5	Phase 3	
	Kel-F 800	2.5	Addendum 11	
X-0359	TNT	25-75	HED-044	100 kg
	NQ	25-75	Phase 3	
*X-0360	RDX	82.0	HED-046	3 kg
	Polyurethane binder	18.0	Phase 2	
*X-0361	RDX	67.0	HED-046	3 kg
	Aluminum	18.0	Phase 2	
	Polyurethane binder	15.0		

*Item added to Page Revision 2

ITED: H. L. Flaugh 4-14-80 DATE	SUBMITTED: DATE	SUBMITTED: DATE
PROVED: R. J. DALY 4/14/80 DATE	APPROVED: R. W. DRAKE 2 May 1980 DATE	APPROVED: L. A. BLACKWELL 5/9/80 DATE

Table 2 (continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0362	AN-FO Aluminum	90.0 10.0	HED-047 Phase 3	50 g
X-0363	AN-FO Aluminum	80.0 20.0	HED-047 Phase 3	50 g
X-0364	AN ADNT KN	40.4 52.4 7.2	HED-042 Phase 2 Addendum 2	1 kg
X-0365	AN ADNT EDD KN	42.0 11.0 39.0 8.0	HED-042 Phase 2 Addendum 2	1 kg
X-0366	AN EDD	50.0 50.0	HED-042 Phase 2 Addendum 2	1 kg
X-0367	AN EDD KN	44.1 48.1 7.8	HED-042 Phase 2 Addendum 2	1 kg
*X-0368	EDD AN KN	50.0 42.5 7.5	HED-048 Phase 3	25 kg
*X-0369	RDX EDD AN Aluminum	14.2 40.3 40.3 5.2	HED-048 Phase 3	25 kg
*X-0370	RDX EDD AN Aluminum	12.8 36.2 36.2 14.8	HED-048 Phase 3	25 kg

*Item added to Page Revision 0

TED: H. L. Flaugh (signature)	9-11-80 DATE	SUBMITTED:	DATE	SUBMITTED:	DATE
ROVED: R. J. DALY (signature)	9/12/80 DATE	APPROVED: for R. W. DRAKE (signature)	10/8/80 DATE	APPROVED: L. A. BLACKWELL (signature)	10/14/80 DATE

Table 2 (continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0371	TATB HMX Estane	51.00 46.00 3.00	HED-021 Phase 3 Addendum 13	100 kg
X-0372	TATB HMX Kraton Oil	51.40 46.30 2.30	HED-021 Phase 3 Addendum 13	100 kg
X-0373	TATB HMX Estane	43.00 55.00 2.00	HED-021 Phase 3 Addendum 13	100 kg
X-0374	TATB HMX Kraton Oil	43.00 55.00 2.00	HED-021 Phase 3 Addendum 13	100 kg
X-0375	RDX TNT Al D-2 Wax	45.00 30.00 20.00 5.00	HED-049 Phase 3	100 kg
X-0376	TATB Oil	27.51 72.49	HED-021 Phase 3 Addendum 12	3 kg
X-0377	TATB Oil	46.06 53.94	HED-021 Phase 3 Addendum 12	3 kg
X-0378	TATB Oil	77.35 22.65	HED-021 Phase 3 Addendum 12	3 kg
X-0379	TATB Oil	80.00 20.00	HED-021 Phase 3 Addendum 12	3 kg
X-0380	TATB Oil	85.00 15.00	HED-021 Phase 3 Addendum 12	3 kg

...ITTED: H. L. Flaugh 11-24-80 DATE	SUBMITTED: DATE	SUBMITTED: DATE
...ROVED: R. J. Daly 11/19/80 DATE	APPROVED: R. W. DRAKE 4 Dec 80 DATE	APPROVED: L. A. BLACKWELL 12/8/80 DATE

Table 2 (continued)

Experimental Code Number	Nominal Composition Weight Percent		Reference HED	Weight Limit
X-0381	BTX*	80.00	HED-038	3 kg
	Sylgard	20.00	Phase 2	
	*5,7-dinitro-1-picryl-benzotriazole			
X-0382	NO	50.00	HED-048	500 kg
	EDD	25.00	Phase 3	
	AN	21.25	Addendum 1	
	KN	3.75		
X-0383	BTF	80.00	HED-038	500 g
	Sylgard	20.00	Phase 2	
			Addendum 1	
X-0384	DATB	80.00	HED-038	500 g
	Sylgard	20.00	Phase 2	
			Addendum 1	
X-0385	PYX	80.00	HED-038	500 g
	Sylgard	20.00	Phase 2	
			Addendum 1	
* X-0386	EDD	42.50	HED-048	227 kg
	AN	36.10	Phase 3	
	KN	6.40	Addendum 2	
	Al	15.00		
* X-0387	EDD	49.00	HED-048	227 kg
	AN	41.60	Phase 3	
	KN	7.40	Addendum 2	
	RDX	2.00		
* X-0388	EDD	32.50	HED-048	227 kg
	AN	27.60	Phase 3	
	KN	4.90	Addendum 2	
	NO	25.00		
	Al	10.00		
* X-0389	TATB	13.46	HED-027	100 kg
	Tungsten	85.24	Phase 3	
	Polystyrene	0.80	Addendum 3	
	DOP	0.50		

*Items added to Page Revision 0

ISSUED: H L Flaugh 8-20-81	SUBMITTED:	SUBMITTED:
H. L. Flaugh DATE	DATE	DA
APPROVED: R J Daly 8/25/81	APPROVED: RW Drake 7 Oct 1981	APPROVED: 6/10/81 Jack L. Baca (for) 10/
R. J. DALY DATE	R. W. DRAKE DATE	(for) L. A. BLACKWELL DA

Table 2 (Continued)

Experimental Code Number	Nominal Composition Weight Per Cent		Reference HED	Weight Limit
X-0390	TATB	6.74	HED-027	100 kg
	HMX	6.60	Phase 3	
	Tungsten	85.36	Addendum 3	
	Polystyrene	0.80		
	DOP	0.50		
X-0391	TNT	80.00	HED-050	91 kg
	LiF	20.00	Phase 3	
X-0392	TPM	80.0 vol%	HED-045	3 kg
	RTV-619	20.0 vol%	Phase 2	
X-0393	TPM	70.0 vol%	HED-045	3 kg
	Epoxy	30.0 vol%	Phase 2	
X-0394*	TATB	47.5	HED-021	100 kg
	HMX	48.7	Phase 3	
	Estane	3.8	Addendum 13	
X-0395	PETN	96.5	HED-051	10 kg
	FPC 461	3.5	Phase 3	
X-0396	TATB	70.0	HED-021	100 kg
	HMX	25.0	Phase 3	
	Estane	5.0	Addendum 13	
X-0397	TATB	70.0	HED-021	100 kg
	HMX	25.0	Phase 3	
	Kraton G	5.0	Addendum 13	
X-0398	TATB	70.0	HED-021	100 kg
	HMX	25.0	Phase 3	
	Kraton G	2.24	Addendum 13	
	HyVac Oil	2.76		
X-0399	TATB	95.0	HED-021	100 kg
	Viton A	5.0	Phase 3	
			Addendum 13	

*Items added to page revision 6, X-0394 was inadvertently deleted from page revision 5.

D. 10-26-83 DATE	SUBMITTED: DATE	SUBMITTED: DATE
VED: 10/21/83 DATE L. Parkinson	APPROVED: 10/28/83 DATE W. A. Bradley	APPROVED: 11/1/83 DAT I. A. Blackwell

Table 2 (Continued)

Experimental Code Number	Nominal Composition Weight Per Cent		Reference HED	Weight Limit
X-0400	PETN FPC-461 Exon	99.5 0.5	HED-051 Phase 3 Addendum 1	5 kg
X-0401	PETN Kel-F 800	99.5 0.5	HED-051 Phase 3 Addendum 1	5 kg
X-0402	PETN Kel-F 800	96.5 3.5	HED-051 Phase 3 Addendum 1	5 kg
X-0403	96.5 wt% HMX 1.57 Kraton G 1.93 Hyvac Oil		HED-035 Phase 3	90 kg
X-0404	98.5 wt% HMX 0.67 wt% Kraton G 0.83 wt% Hyvac Oil		HED-035 Phase 3	90 kg
X-0405	90.0 wt% HMX 0.89 Kraton G 1.11 Hyvac Oil		HED-035 Phase 3	90 kg
X-0406	97.2 HMX 1.27 Kraton G 1.53 Hyvac Oil		HED-035 Phase 3	200 lbs
X-0407*	69.8 wt% TATB 25.0 wt% PETN 5.0 wt% Kel-F 800 0.2 wt% Dye		HED-021 Phase 2	3 kg
X-0408*	97.5 wt% HMX 2.5 Vistalon 503		HED-052	150 g
X-0409*	97.5 wt% HMX 2.5 wt% Royalene 100		HED-052	150 g

*Item added to page revision 1.

UBMITTED:		SUBMITTED:		SUBMITTED:	
R. E. Flanagh	DATE 8-2-84		DATE		DAT
PPROVED: L. Parkinson	8/2/84	APPROVED: W. A. Bradley	8/2/84	APPROVED: W. E. Barrington	8/8
W. Parkinson	DATE	W. A. Bradley	DATE	HSE-3	DAT

Table 2 (Continued)

Experimental Weight Code Number	Nominal Composition Weight Per Cent	HED	Reference Limit
X-0410	97.5 wt% HMX 1.25 wt% Polysar 306 1.26 wt% Tufflo 6026	HED-052	150 g
X-0411	97.5 wt% HMX 1.0 wt% Kraton G 1650 0.25 wt% Vistalon 457 1.25 wt% Tufflo 6026	HED-052	150 g
X-0412	79.0 wt% RDX 21.0 wt% FSL 7210	HED-008	3500 g
X-0413	79.0 wt% PETN 21.0 wt% FSL 7210	HED-008	3500 g
X-0414	84 wt% HMX 12.48 wt% R45M 0.52 wt% IPDI 3.0 wt% Dioctyl Adipate	HED-053	500 kg
X-0415	60 wt% HMX 40 wt% EAK	HED-048 Phase 3 Addendum 3	100 kg
X-0416	40 wt% HMX 60 wt% EAK	HED-048 Phase 3 Addendum 3	100 kg
X-0417	20 wt% HMX 80 wt% EAK	HED-048 Phase 3 Addendum 3	100 kg
X-0418	97.5 wt% HMX 1.12 wt% Kraton G 1650 1.38 wt% Synton PAO 100	HED-035	50 lb Phase 3

SUBMITTED:	SUBMITTED:	SUBMITTED:
DATE 8-2-84	DATE	DATE
APPROVED: J. L. Parkinson DATE 8-2-84	APPROVED: W. A. Bradley DATE 8/2/84	APPROVED: HSE-3 DATE 8/8

Table 2 (Continued)

Experimental Weight Code Number	Nominal Composition Weight Per Cent	HED	Weight Limit
X-0419	97.5 HMX 2.5 Vistalon 404	HED-052	150 g
X-0420	94% DINGU 5% Exon 461 1% KR138S	HED-055	100 kg
X-0421	20 wt% TATB 80 wt% EAK	HED-048	100 kg
X-0422	97.5 HMX 2.5 Ep Syn 3007	HED-052	150 g
X-0423	97.5 HMX 2.5 Ep Syn 4006	HED-052	150 g
X-0424	79.0 wt% RDX 21.0 wt% NuSil CF1-3500	HED-008	3500 g
X-0425	79.0 wt% PETN 21.0 wt% NuSil CF1-3500	HED-008	3500 g
X-0426	95.0 wt% PYX 5.0% wt% Kel-F 800	HED-054	454 kg
X-0427	77% PETN 23% NuSil CF1-3500	HED-008	3500 g
X-0428	75 wt% PETN 25 wt% NuSil CF1-3500	HED-008	3500 g
X-0429	95 wt% DINGU 5 wt% Exon 461	HED-055	100 kg
X-0430	88% HMX 6% Kraton G-1650 6% Tufflo 6026 oil	HED-035	91 kg
X-0431	75% PETN 25% Nu-Sil CF2-3500	HED-008	3500 g

SUBMITTED:	SUBMITTED:	SUBMITTED:
Barry E. Hatler 9/24/85 DATE	DATE	
APPROVED: 9/24/85	APPROVED: D.M.A. Bradley 9/27/85	APPROVED:

Table 2 (Continued)

Experimental Code Number	Nominal Composition Weight Per Cent	Reference HED	Weight Limit
X-0432	60% DINGU 40% TNT	HED-055 Add. 1	100 kg
0-0433	79.8% TATB (Micronized) 15.0% HMX (Ball Milled) 5.0% Kel-F 800 0.2% Dye	HED-021	100 kg
X-0434	64.8% TATB 30.0% PETN 5.0% KEl-F 800 0.2% Dye	HED-021 Add. 15	3 kg
X-0435	70% TATB 25% HMX (specially ground to Class E) 5% Estane	HED-021 Phase 3 Add. 13	100 kg
X-0436	90% HMX 7.4% CAB 2.5% NP 0.1% KR 138S	HED-056 Phase 2	3 kg
X-0437	85% HMX 11.2% CAB 3.7% NP 0.1% KR 138S	HED-056 Phase 2	3 kg
X-0438*	80.5% HMX 9.5% BDNPA/F 9.5% Estane 0.5% Calcium Stearate	HED-013 Add.8	100 kg
X-0439*	75% PETN 25% Nu-Sil CF3-3500	HED-008	3500 g
X-0440*	70% PETN 30% Nu-Sil CF3-3500	HED-008	3500 g
X-0441*	58% RDX 34% Viton 8% Calcium Tartrate	HED-057	15 kg

*Item added to page Revision 1

UPDATED: [signature] 4/28/86 DATE	SUBMITTED: DATE	SUBMITTED: DATE
APPROVED: [signature] 4/1/86 DATE L. Parkinson	APPROVED: M. A. Bradley 5/2/86 DATE W. A. Bradley	APPROVED: W. C. Courtney 6/16/8 DATE HSE-3

Table 2 (Continued)

Experimental Code Number	Nominal Composition Weight Per Cent	Reference HED	Weight Limit
X-0442	70% RDX 10% Kraton 10% Tufflo 6026 Oil 10% Calcium Tartrate	HED-057	15 kg
X-0443	85% TATB 15% Viton	HED-057	15 kg
X-0444	88% HMX 6% Estane 6% BDNPA/BDNPF	HED-013 Add. 8	100 kg
X-0445	80% PETN 20% Nu-Sil CF3-3500	HED-008 Phase 3 Add. 5	3500 g
X-0446*	50% RDX 35% Viton 15% Calcium Tartrate	HED-057 Phase 3 Add. 1	15 kg
X-0447*	58% RDX 10% Kraton 10% Tufflo 6026 Oil 22% Calcium Tartrate	HED-057 Phase 3 Add. 1	15 kg
X-0448*	80% TATB 20% Viton	HED-057 Phase 3 Add. 1	15 kg
X-0449*	60% RDX 25% Estane 15% Calcium Tartrate	HED-057 Phase 3 Add. 1	15 kg
X-0450*	60.9% TATB 35.0% HMX 4.1% Estane	HED-021 Phase 3 Add. 13	100 kg
X-0451*	78% PETN 22% Nu-Sil CF3-3500	HED-008 Phase 3 Add. 5	3500 g

*Item added to page Revision 0

SUBMITTED: S J Hatler 7/3/86 DATE	SUBMITTED: DATE	SUBMITTED:
APPROVED: [signature] 7/8/86 J. L. Parkinson DATE	APPROVED: W.A. Bradley 7/8/86 W. A. Bradley DATE	APPROVED: Jack L. Bassham For WCC 8/4 HSE-3 Date

Table 2 (Continued)

Experimental Code Number	Nominal Composition Weight Per Cent	Reference HED	Weight Limit
X-0452	78% PETN 22% Nu-Sil CF4-3500	HED-008 Phase 3 Add. 5	3500 g
X-0453	78% PETN 22% Nu-Sil CF5-3500	HED-008 Phase 3 Add. 5	3500 g
X-0454	58% RDX 15% Estane 10% CEF 17% Calcium Tartrate	HED-057 Phase 3 Add. 1	15 kg
X-0455	75% PETN 25% Nu-Sil CF5-3500	HED-008 Phase 3 Add. 5	3500 g
X-0456	70% PETN 30% Nu-Sil CF5-3500	HED-008 Phase 3 Add. 5	3500 g
X-0457	78% PETN 22% NuSil CF6-3500	HED-008 Add. 5	3500 g
X-0458	95% TATB (wet aminated) 4.8% Kel-F 800 0.2% Dioctyl Sebacate (Octoil-S)	HED-021 Phase 3 Add. 12	100 kg
X-0459*	95.6% TATB 4.38% EYPEL-F 0.02% 2,2-dichlorobenzoyl peroxide in silicone base (catalyst)	HED-021 Phase 2 Add. 18	3000 g
X-0460*	59% HMX 11.5% Kraton 11.5% TCP 18 CT	HED-057 Phase 3 Add. 1	15 kg

*Item added to Page Revision 1

SUBMITTED:		SUBMITTED:		SUBMITTED:	
[signature]	3/16/87 DATE		DATE		DATE
APPROVED:		APPROVED:		APPROVED:	
[signature] J. L. Parkinson	3/18/87 DATE	W. A. Bradley	DATE	HSE-3	DATE

Table 2 (Continued)

Experimental Code Number	Nominal Composition Weight Per Cent	Reference HED	Weight Limit
X-0461	78% PETN 22% NuSil CF7-3500	HED-008 Phase 3 Add. 5	3500 g
X-0462*	97.8% TATB 2.0% Kraton G 1650 0.2% Hypalon 20	HED-021 Phase 3 Add. 12	250 kg
X-0463	97.47% HMX 1.25% Kraton G 1650 1.25% Tufflo 6026 Oil 0.03% Irganox	HED-035 Phase 3	250 kg
X-0464	≤60% TNT ≥40% Calcium Carbonate	HED-030 Phase 1 Add. 1	3 kg
X-0465	≤70% TNT ≥30% Oxamide	HED-030 Phase 2 Add. 1	3 kg
X-0466	≤70% TNT ≥30% Cyanuric Acid	HED-030 Phase 2 Add. 1	3 kg
X-0467	≤70% TNT ≥30% Zinc Oxide	HED-030 Phase 2 Add. 1	3 kg
X-0468	86% TATB 6% Vistanex MML-100 6% Tufflo 6026 2% 032-4500 Microballoons	HED-021 Phase 3 Add. 12	10 kg
X-0469*	CLASSIFIED COMPOSITION	HED-057 Phase 3 Add. 1	10 kg

*Item added to Page Revision 1

SUBMITTED:	DATE	SUBMITTED:	DATE	SUBMITTED:	
[signature]	3/8/88				
APPROVED:		APPROVED:		APPROVED:	
[signature]	3/11/88 DATE	W. A. Bradley [signature]	3/4/88 DATE	HSE-3 [signature]	3/[illegible]
J. L. Parkinson					

Table 2 (Continued)

X-0470*	CLASSIFIED COMPOSITION	HED-057 Phase 3	15 kg
X-0471	75% HMX 25% Emulsion	HED-058 Phase 3	25 kg
X-0472	50% HMX 50% Emulsion	HED-058 Phase 3	25 kg
X-0473	25% HMX 75% Emulsion	HED-058 Phase 3	25 kg
X-0474	100% Emulsion	HED-058 Phase 3	25 kg
X-0475 *	CLASSIFIED COMPOSITION	HED-057 Phase 3	15 kg
X-0476 *	CLASSIFIED COMPOSITION	HED-057 Phase 3	15 kg
X-0477	70% HMX 30% Emulsion	HED-058 Phase 3	25 kg
X-0478	40% HMX 60% Emulsion	HED-058 Phase 3	25 kg
X-0479	30% HMX 70% Emulsion	HED-058 Phase 3	25 kg
X-0480	20% HMX 80% Emulsion	HED-058 Phase 3	25 kg
X-0481	10% HMX 90% Emulsion	HED-058 Phase 3	25 kg
X-0482	78% PETN 22% NuSil CF-2-3550	HED-008 Phase 3 Add. 5	3.5 kg

*Items added to Page Revision 0

SUBMITTED: [signature] DATE 3/8/88	SUBMITTED: DATE	SUBMITTED:
APPROVED: [signature] DATE 3/11/88 L. L. Parkinson	APPROVED: W. A. Bradley 3/18/88 DATE W. A. Bradley	APPROVED: [signature] 3/ HSE-3

Table 2 (Continued)

X-0483	95% NTO 5% Exon 461	HED-059 Phase 2	3.0 kg
X-0484	95% NTO 5% Viton A	HED-059 Phase 2	3.0 kg
X-0485	95% NTO 5% Kel-F 800	HED-059 Phase 2	3.0 kg
X-0486	95% NTO 5% Kraton 1650	HED-059 Phase 2	3.0 kg
X-0487	95% NTO 5% Estane 5703	HED-059 Phase 2	3.0 kg
X-0488	40% NTO 60% TNT	HED-060 Phase 2	3.0 kg
X-0489	50% NTO 50% TNT	HED-060 Phase 2	3.0 kg
X-0490	60% NTO 40% TNT	HED-060 Phase 2	3.0 kg
X-0491*	45% NTO 50% RDX 5% Viton A	HED-059 Phase 2 Add. 1	3.0 kg
X-0492*	45% NTO 50% RDX 5% Estane	HED-059 Phase 2 Add. 1	3.0 kg
X-0493*	45% NTO 50% RDX 5% FPC 461	HED-059 Phase 2	3.0 kg
X-0494*	45% NTO 50% RDX 5% Kel-F 800	HED-059 Phase w Add. 1	3.0 kg
X-0495*	45% NTO 50% RDX 5% Kraton 1650	HED-059 Phase 2 Add. 1	3.0 kg
X-0496*	60% HMX 40% Emulsion	HED-058 Phase 3	25 kg

*Item added to page Revision 0

SUBMITTED:	SUBMITTED:	SUBMITTED:
SE Statler 3/8/88 DATE	DATE	
APPROVED: 3/4/88 J. L. Parkinson DATE	APPROVED: W. A. Bradley 3/18/88 W. A. Bradley DATE	APPROVED: W. G. Cowthorne 3/1[illegible] HSE-3

Table 2 (Continued)

X-0497	95% TATB 5% Polysar 306	HED-052 Phase 1	150 g
X-0498	95% TATB 5% Vistalon 404	HED-052 Phase 1	150 g
X-0499	95% TATB 5% Polyvinylidene Fluoride	HED-021 Phase 3	100 kg
X-0500	95% TATB 5% Poly(vinylidene Fluoride/ hexafluoropropylene)	HED-021 Phase 3	100 kg
X-0501	78% RDX 22% CF6-3500	HED-008 Phase 3 Add. 5	3500 g
X-0502*	50% Dinitrotolune 49.7% D-2wax 0.3% Dye	HED-061 Phase 2	3 kg
X-0503*	85% NTO 10% RDX 5% Estane	HED-059 Phase 2 Add. 1	3 kg
X-0504*	85% NTO 10% RDX 5% FPC 461	HED-059 Phase 2 Add. 1	3 kg
X-0505*	85% NTO 10% RDX 5% Kel-F 800	HED-059 Phase 2 Add. 1	3 kg
X-0506*	85% NTO 10% RDX 5% Kraton 1650	HED-059 Phase 2 Add. 1	3 kg
X-0507*	82% HMX 18% Estane	HED-013 Phase 3 Add. 9	100 kg

*Item added to page Revision 0

Table 2 (Continued)

X-0508	81% HMX 15% Estane 4% BDNPA/F Eutectic	HED-013 Phase 3 Add. 9	100 kg
X-0509	88% HMX 5.4% Kraton G 1650 6.6% Tufflo Oil	HED-035 Phase 3 Add. 4	250 kg
X-0510	85% NTO 10% RDX 5% Viton A	HED-059 Phase 2 Add. 1	3 kg
X-0511*	95% HMX 5% Vistalon 404	HED-035 Phase 3 Add. 4	250 kg
X-0512*	88% HMX 12% Vistalon 404	HED-035 Phase 3 Add. 4	250 kg
X-0513*	40% TNT 50% $CaCO_3$ (Calcium Carbonate) 10% Estane	HED-030 Phase 3 Add. 3	500 kg
X-0514*	45% TNT 50% $CaCO_3$ 5% Estane	HED-030 Phase 3 Add. 3	500 kg
X-0515*	40% TNT 50% Cyanuric Acid 10% Estane	HED-030 Phase 3 Add. 3	500 kg
X-0516*	40% TNT 50% Zinc Oxide 10% Estane	HED-030 Phase 3 Add. 3	500 kg
X-0517*	40% TNT 50% Oxamide 10% Estane	HED-030 Phase 3 Add. 3	500 kg
X-0518*	50% PETN 30% Pentaerythritol 20% Sylgard 182	HED-008 Phase 3 Add. 6	10 kg

*Item added to Page Revision 0

SUBMITTED: S E Hatler 5/24/88 DATE

SUBMITTED: DATE

SUBMITTED:

APPROVED: Bill Man 5/25/88

APPROVED: [illegible] A. Buller 5/26/88

APPROVED: Jack L. Becker for [illegible] 7/2

Table 2 (Continued)

X-0519	60% PETN 20% Pentaerythritol 20% Sylgard 182	HED-008 Phase 3 Add. 6	10 kg
X-0520	70% PETN 10% Pentaerythritol 20% Sylgard 182	HED-008 Phase 3 Add. 6	10 kg
X-0521	50% TNT 40% $CaCO_3$ 10% Estane	HED-030 Phase 3 Add. 3	500 kg
X-0522*	80% RDX 20% CF6-3500	HED-008 Phase 3 Add. 5	3.5 kg
X-0523*	51% RDX 12.5% Estane 5703 12.5% CEF 24% Cyanuric Acid	HED-057 Phase 3	15 kg
X-0524 *	95% TATB 4.8% Kel-F 800 0.2% Hypalon	HED-021 Phase 3 Add. 5	2000 kg
X-0525*	≤70% TNT ≥30% Calcium Carbonate Cab-o-sil	HED-030 Phase 2	2 kg
X-0526*	≤70% TNT ≥30% Calcium Carbonate Talc	HED-030 Phase 2	2 kg
X-0527*	97% TATB 3% Macrolon (Polycarbonate)	HED-21 Phase 3 Add. 12	100 kg
X-0528*	84% HMX 7.6% R45HT 7.6% DOA 0.8% IPDI	HED-053 Phase 3	25 kg

*Item added to Page Revision 0

SUBMITTED: [signature] DATE 4/14/89	SUBMITTED: DATE	SUBMITTED:
APPROVED: Bill May 4/18/89	APPROVED: [signature] 5-8-89	APPROVED: [signature] 5/2

Table 2 (Continued)

X-0529	≤97.5% HMX ≥ 2.5% Vistalon 503	HED-035 Phase 3 Add. 4	250 kg
X-0530	Kinepak Mixture ≈80% An + sensitizers ≈20% NM	HED 062 Phase 2	3 kg
X-0531	98% TATB 2% Polysar 306	HED 021 Phase 3 Add. 5	250 kg
X-0532	98% TATB 2% Vistalon 404	HED 021 Phase 3 Add. 5	250 kg
X-0533	40% TNT 55-60% Calcium Carbonate 0-2% Talc 1-2% Microballoons	HED-030 Phase 3 Add. 4	500 kg
X-0534	50% TNT 16-24% Calcium Carbonate 25-33% Talc 1-2% Microballoons	HED-030 Phase 3 Add. 4	500 kg
X-0535*	95% TZX 5% OXY-461	HED-064 Phase 2	3 kg
X-0536*	20-30% RDX 50-65% ZnO 14-20% R45HT/IPDI Binder	HED-063 Phase 2	3 kg
X-0537*	≤90% HMX ≥10% R45T/IPDI Type Binder	HED-053 Phase 3 Rev. 1	25 kg
X-0538*	20-80% TATB 20-80% NTO 0-10% Kel-F 800	HED-059 Phase 2 Add. 3	3 kg

*Item added to Page Revision 0

SUBMITTED: [signature] 4/25/90 DATE	SUBMITTED: DATE	SUBMITTED:
APPROVED: [signature] J. L. Parkinson 4/30/90 DATE	APPROVED: Wm. A. Bradley W. A. Bradley 5/2/90 DATE	APPROVED: HSE-3

Table 2 (Continued)

Experimental Code Number	Nominal Composition Weight Per Cent	Reference HED	Weight Limit
X-0539	44% RDX (Micronized) 12.5% Estane 5703 12.5% CEF 31% Cyanuric Acid	HED-057 Phase 3 Add. 2	15 kg
X-0540	39% RDX (Micronized) 12.5% Estane 5703 12.5% CEF 31% Cyanuric Acid	HED-057 Phase 3 Add. 2	15 kg
X-0541	69.8% TATB 25.0% PETN 5.0% Kel-F 800 0.2% Blue Dye (Freon Process)	HED-021 Phase 3 Add. 16	100 kg
X-0542	95% TATB 5% L-9267, Fluoroplastic terpolymer (3M)	HED-021 Phase 3 Add. 5	250 kg
X-0543	95% TATB 5% Kel-F 3700	HED-021 Phase 3 Add. 5	250 kg
X-0544	26% TATB 74% Ammonium Nitrate	HED-066 Phase 2	3 kg
X-0545	76% RDX 12% Cellulose Acetate Butyrate (CAB) 7.6% Acetyl Triethyl-citrate (ATEC) 4.0% Nitrocellulose 0.4% Ethylcentralite	HED-056 Phase 2 Add. 2	3 kg

...TED: S E Hatler 2/27/91 DATE	SUBMITTED: DATE	SUBMITTED: D
...ROVED: L G Stretz 3/4/91 DATE L. Stretz	APPROVED: Wm. A. Bradley 3/4/91 DATE W. A. Bradley	APPROVED: K H Crider 3/4/91 D HSE-3

WX-3

STANDARD OPERATING PROCEDURE

FOR

APPROVED DETONATORS (TABLE 3)

Prepared By: ______ **Date** 5/10/93
T. F. Covert, Section Leader, WX-3

Approved By: ______ **Date** 5/11/93
L. A. Stretz, Group Leader, WX-3

Approved By: J. Michael Kelly for **Date** 5/18/93
W. A. Bradley, Division Operations Coordinator, WX-DO

Approved By: ______ **Date** 5/14/93
W. Patterson, M-7

Approved By: P. D. Whitehead **Date** 6-23-93
P. D. Whitehead, Safety Officer, HS-5

Los Alamos
National Laboratory

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TABLE 3
APPROVED DETONATORS

1.0 High-Energy Exploding Bridgewire (EBW) Detonators

The following EBW, slapper and high energy detonators have been approved for assembly into test devices:

#1E23		#ER-396A	SE1
#1E26	#ER-325	#ER-396B	SE1/31
#1E26B	#ER-312B	#ER-402	RP1
#1E29	#ER-344	#ER-403	RP1/31
#1E30	#ER-349	*#ER-403B	RP2
#1E33	#ER-350		RP80
#1E34	#ER-351		RP84
#1E36	#ER-352		RP87
#1E38 T.F.	#ER-353		
#1E38	#ER-370		
	#ER-371	#MK20	
	#ER-377	#MK22A	
	#ER-380	#MK13C	
	#ER-400		

2.0 The following low energy detonators have been approved for assembly into test devices: 3E1, 3E1A, 3E1D.

3.0 The following low-energy actuators and igniter have been approved for assembly into test devices:

2S/2052	Actuator	*3S/PT06	Actuator
2S/STP/150	Actuator	*4S/152	Actuator
3X/2052	Igniter	*5S/152	Actuator
*6S/PT06	Actuator	*7S/152	Actuator
*8S/2052	Actuator		

Note: To provide safe handling, the actuators and igniter listed above will be assembled into a valve body or an assembly that will provide confinement before they are furnished to WX-3 for subsequent assembly. Shorting plugs will be installed until connected to next assembly.

Approved by Nuclear Explosive Safety Study for use, at NTS, in nuclear explosive assembly.

* Indicates addition.

4.0 DESIGN, OPERATIONS, AND PROCESS INFORMATION

This section presents a brief description of the open burning/open detonation (OB/OD) thermal treatment units addressed in this Part B permit application as well as an overview of the design, general operations, and process information applicable to these waste management units. Information provided in this section is submitted to address the applicable miscellaneous unit requirements of the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), Subpart IX, 270.23, and 20 NMAC 4.1, Subpart V, Part 264, Subpart X, revised November 1, 1995, as well as the requirements for thermal treatment units in 20 NMAC 4.1, Subpart VI, Part 265, Subpart P, revised November 1, 1995. Information that is identical for Technical Area (TA) 14, TA-15, TA-36, and TA-39 is consolidated.

4.1 HAZARDOUS WASTE OB/OD THERMAL TREATMENT UNITS NEAR TA-14, BUILDING 23 (TA-14-23) [20 NMAC 4.1, Subpart IX, 270.23; 20 NMAC 4.1, Subpart V, Part 264, Subpart X; and 20 NMAC 4.1, Subpart VI, Part 265, Subpart P]

This section provides unit descriptions and an overview of the waste management practices for the hazardous waste OB/OD thermal treatment units located near TA-14-23 at Los Alamos National Laboratory (LANL). The OB/OD thermal treatment units at TA-14 include a burn cage for OB of explosives-contaminated items such as paper, tape, debris, and soil, and an OD area for treatment of waste explosives. The OD thermal treatment unit is also used for nontreatment-related experimental test detonations (i.e., shots). The descriptions include the location, the physical parameters, the materials of construction, and the maximum treatment capacity of the OB/OD thermal treatment units. A discussion of waste management practices, including those related to waste packaging and handling, is presented in Section 4.5.

The two thermal treatment units at TA-14 are located approximately 180 feet south of structure TA-14-23 (the control building); this area is also known as Q-Site East. OB treatment operations are carried out in a burn cage located in the eastern portion of Firing Mound 3, adjacent to the OD area. The burn cage, which measures approximately 3 feet high and 2 feet in diameter, is constructed of 1/4-inch-thick steel and sits in a steel tray with three-inch raised edges. The steel tray measures 4 feet long and 2.5 feet wide. The secondary containment tray prevents run-on into the burn cage. The steel tray rests on bare soil. The burn cage, which is not lined, has a wire mesh and steel door measuring 2 feet 10 inches high and 1 foot 7 inches wide. The door is attached to the front of the unit and closes with a latch. A steel mesh screen is located inside the unit one foot above the containment tray. Explosives-contaminated wastes to be burned are placed on this screen. A wire mesh screen also covers the top of the OB unit. An engineering drawing of the OB unit is provided in Appendix A of this document. OB operations are monitored from the control building (TA-14-23).

Ash resulting from OB operations is removed from the secondary containment tray within approximately 24 hours after each burn; it is not allowed to accumulate. The ash is placed in a 55-gallon drum and stored in a satellite accumulation area near TA-14-23. The OB unit is covered with a tarp once the ash is removed. In addition, the OB unit is covered with a tarp when not in use (per DX-2:SOP 6.1.5) to prevent accumulation of precipitation in the unit that could potentially result in run-off to the environment.

The OD area, referred to as Firing Mound 3, is a gently sloping, sand-covered area measuring approximately 40- by 75-feet. There are no trenches or pits associated with the OD unit; thus, no hydraulic head will be created to drive waste constituents into the vadose zone. A berm will be constructed downslope of the OB/OD units to prevent runoff from both units and to minimize the erosion potential. The berm will be inspected routinely and maintained, as necessary. A natural drainage upslope and just north of the OD unit (along the dirt road) and the paved road just west of the OD unit divert potential run-on away from the unit (for the locations of these roads and the proposed berm see Map 2 of the "Part A Permit Application—Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39," Revision 1.0 (hereinafter referred to as the revised OB/OD Part A). In addition, the parking lot adjacent to the control building (TA-14-23) is upgradient of the OB/OD units and slopes to the east, which further prevents potential run-on to the OB/OD units. Because the OD unit is simply an area on soil-covered tuff, an engineering drawing cannot be developed for the OD unit. The topography and areal extent of the OD unit are shown on Map 2 of the revised OB/OD Part A. Following waste placement at Firing Mound 3, detonation operations are conducted from the control building. Operations at the OD unit require post-detonation visual surveys for materials not consumed by the detonation. This practice minimizes the potential for precipitation contacting untreated hazardous waste, if any. The locations of the thermal treatment units at TA-14 are shown on Figure 4-1 of this document and on Map 2 of the revised OB/OD Part A.

A maximum of 50 pounds of explosives-contaminated materials may be burned per treatment at the OB unit. A maximum of 20 pounds of waste explosives may be detonated per treatment at the OD thermal treatment unit. Since RCRA Subtitle C regulations became effective in November 1980, an average of 100 to 150 pounds of waste has been treated at the OB unit annually, and an average of 40 to 80 pounds of waste has been treated annually at the OD unit.

The wastes treated are both homogeneous (e.g., solid explosives, scrap explosives) and heterogeneous (e.g., explosives-contaminated paper, rags, wood). These wastes have been assigned the following EPA Hazardous Waste Numbers: D001 for ignitability; D003 for reactivity; D005 (for the barium in the explosives); and F005 (for spent nonhalogenated solvents, which here include toluene and methyl ethyl ketone on the explosives-contaminated rags and wipes). Historically, there have been no significant changes in waste compositions. The wastes are treated to remove the characteristic of reactivity, although other characteristic (ignitability, toxicity for barium) and listed (solvents on the explosives-contaminated rags and wipes) hazardous waste may be present in the wastes being treated.

4.2 HAZARDOUS WASTE OD THERMAL TREATMENT UNIT NEAR TA-15-184 [20 NMAC 4.1, Subpart IX, 270.23; 20 NMAC 4.1, Subpart V, Part 264, Subpart X; and 20 NMAC 4.1, Subpart VI, Part 265, Subpart P]

This section provides a unit description and an overview of the waste management practices for the hazardous waste OD thermal treatment unit located near TA-15-184. The description includes the location, the physical parameters, the materials of construction, and the maximum treatment capacity of the OD thermal treatment unit. A discussion of waste management practices, including those related to waste packaging and handling, is presented in Section 4.5.

The OD thermal treatment unit at TA-15 is located near TA-15-184 and may be used to open detonate solid and liquid hazardous explosive waste. As shown on Figure 4-2, the unit extends approximately 150 feet from the northeast to the southeast of TA-15-184. The area, which covers approximately 17,663 square feet, is generally flat and sand-covered and slopes gently to the southwest. Two steel plates that measure 0.5 foot thick, 5 feet wide, and 20 feet long are located on the ground adjacent to TA-15-184. The plates are laid lengthwise end-to-end with one end against the building. Various small housings for cameras and instrumentation are located at the site. Sand bags are used to protect TA-15-184 and the small housings from the impact of detonations.

The OD thermal treatment unit may be used to treat a maximum of 500 pounds of explosive waste per detonation. The unit is currently used for nontreatment-related experimental test detonations (i.e., shots); however, waste treatment has not yet been conducted.

4.3 HAZARDOUS WASTE OD THERMAL TREATMENT UNIT NEAR TA-36-8 [20 NMAC 4.1, Subpart IX, 270.23; 20 NMAC 4.1, Subpart V, Part 264, Subpart X; and 20 NMAC 4.1, Subpart VI, Part 265, Subpart P]

A description of the hazardous waste OD thermal treatment unit located near TA-36-8 is provided below. The description includes the location, the physical parameters, and the maximum treatment capacity of the OD thermal treatment unit. A discussion of waste management practices, including those related to waste packaging and handling, is presented in Section 4.5.

The OD thermal treatment unit located near TA-36-8 may be used to treat solid and liquid hazardous explosive waste. The OD thermal treatment unit is an irregularly-shaped, sand- and grass-covered area that measures approximately 550 feet east to west and 300 feet north to south, as shown on Figure 4-3. The area is relatively flat.

The OD thermal treatment unit has a maximum treatment capacity of 2,000 pounds of explosive waste per detonation. The unit is used primarily for nontreatment-related experimental test detonations and may occasionally be used for treatment of hazardous explosive waste.

4.4 HAZARDOUS WASTE OD THERMAL TREATMENT UNITS AT TA-39 [20 NMAC 4.1, Subpart IX, 270.23; 20 NMAC 4.1, Subpart V, Part 264, Subpart X; and 20 NMAC 4.1, Subpart VI, Part 265, Subpart P]

This section provides a description of the hazardous waste OD thermal treatment units associated with structures TA-39-6 and TA-39-57 at TA-39. The description includes the location, the physical parameters, the materials of construction, and the maximum treatment capacities of the thermal treatment units. A discussion of waste management practices, including those related to waste packaging and handling, is presented in Section 4.5.

The OD thermal treatment units at TA-39 are associated with TA-39-6 and TA-39-57 (Figures 4-4 and 4-5). Each of the areas is a relatively flat sand-covered area, measuring approximately 40- by 40-feet, and is located in the canyon bottom. Steep canyon walls rise to heights of 100 feet or more in the immediate vicinity of each OD area, roughly forming a semicircle around each area. The canyon walls serve to attenuate the force of the blasts. The associated control buildings (i.e., TA-39-6 and TA-39-57) are reinforced concrete structures extending partially beneath the detonation areas.

The maximum treatment capacity at each of the TA-39 OD units is 1,000 pounds.

4.5 WASTE MANAGEMENT PRACTICES [20 NMAC 4.1, Subpart V, Part 264, Subpart X]

There are two basic categories of explosives that may be managed at the OB/OD thermal treatment units addressed in this Part B permit application. The first category consists of explosives-contaminated waste; the second category consists of explosive material. Explosives-contaminated waste is further divided into subcategories as follows: (1) make-up room wastes, (2) Type I material, (3) Type II material, and (4) Type III material. These wastes are defined as follows:

- Make-up room waste - Explosives-contaminated waste, such as paper towels, swabs, and similar materials that contain no tangible pieces of explosives but are used in the preparation of shots in the make-up building.
- Type I material - Firing mound debris that is potentially contaminated with explosives and consists of wood scraps, cardboard, burlap, and Plexiglass/Lexan.
- Type II material - Firing site debris that is potentially contaminated with explosives and consists of plastic, glass, styrofoam, electrical cables, and metallic foils used for pin switches.
- Type III material - Firing site debris that is potentially contaminated with explosives and consists of metals such as target plates. Type III material also includes corrective action wastes or wastes generated as a result of investigation or remediation.

The second category (i.e., explosive material) includes the following subcategories: (1) explosives assemblies and explosives that are unsafe to handle; (2) identifiable scrap explosives that are safe to handle; (3) identifiable booster charge scrap; and (4) any other process or cleanup wastes that are believed to be potentially reactive.

Waste to be treated is collected from various accumulation areas in and around nearby buildings at the facility. When loading waste, the cargo compartment of the transport vehicle is checked to ensure that it is clean and contains no loose items such as tools or pieces of metal. For transport, the wastes are placed in an enclosed compartment or secured with tie-downs. As stated in DX-16:SOP 1.9, the load limit for transporting explosives is 55 pounds. Wastes are transported by appropriately trained personnel in a designated vehicle to the OB/OD thermal treatment unit on the day of planned treatment. Only the amount of waste that can be treated in one day is transported to the unit. The waste is then unloaded from the vehicle and placed at the OB or OD location by qualified technicians/specialists. Depending on preparation activities, the time during which waste may remain at the unit typically ranges from several minutes to a few hours. A visual examination is conducted after unloading to ensure that no explosive material remains. Preparation room operations and explosives charge handling and assembly are addressed in DX-4:SOP 3; packaging and transportation procedures are presented in DX-DO:SOP 3. OB of explosives-contaminated waste consists of placing the waste in the burn cage, coating the waste with starter fluid, and igniting the waste. OD of waste is accomplished by using a predetermined amount of explosive to initiate the detonation. The detonation may create temperatures up to 3,000 degrees Fahrenheit (1,649 degrees Celsius). Initiation for all waste treatment operations will be performed remotely by qualified personnel from inside a control building/bunker. Thermal treatment operations are conducted in accordance with the most recent, approved versions of LANL standard operating procedures (SOP) (see Appendix B). Other relevant LANL SOPs will also be followed, as appropriate.

SOPs do not require wetting of the TA-14 open burn area before and after each operation. Measures taken to minimize releases of hazardous waste from the TA-14 open burn area to environmental media include using sufficient fuel to aid in ignition and enhance waste destruction, covering the top of the burn cage with wire mesh to minimize the release of burning material, not conducting operations during adverse weather conditions (e.g., high winds), and using secondary containment beneath the OB unit to contain treated or undestroyed material and ash residue. Ash residues from the TA-14 OB unit are removed 24 hours or more after treatment (a time sufficient to allow complete cooling) and are containerized and managed appropriately outside of TA-14-23.

SOPs for OD require a thorough survey of the area after detonation, collection of identifiable pieces of material not consumed by the detonation, and subsequent detonation of these materials. The Firing Leader determines when it is safe to re-enter the detonation site, as described in DX-4:SOP 27.

Waste containers for explosives-contaminated waste and explosive material generally consist of paper-lined cardboard boxes. Most wastes contaminated with explosives and actual pieces of explosives will not be packaged together. Explosives-contaminated waste will be placed within a paper-lined cardboard box with a lid. Once a cardboard box is filled, it will be closed, sealed with tape, and marked "HE Hazardous Waste." These waste containers will then be stored in an accumulation area.

Pieces of damaged explosives resulting from a misfire, sensitivity experiment, incomplete detonation, or exposure to severe testing will be packaged separately from excess explosives. The waste explosives will be stored in an accumulation area. Exceptions to handling will be done on special items and will be handled safely and appropriately.

Releases of propellants, explosives, or pyrotechnics are minimized by following the procedures in DX-4:SOP 3, DX-4:SOP 4, and DX-4:SOP 27 (see Appendix B of this document) to ensure maximum burns or detonations and to minimize misfires. Materials that are not consumed during a burn or detonation are collected and treated until consumed. During OB treatment operations, the heavy gauge wire mesh door and screen control dispersion of materials. Materials not consumed during a burn are collected after the cooling period (i.e., after 24 hours); ash that has collected in the containment tray is removed and managed appropriately. Materials not consumed during a detonation are collected after the Firing Leader ensures that the area is safe. Treatment operations are not conducted during adverse conditions (see Section 4.6.4.3) in order to minimize wind dispersal of ash and particulate matter to the environment.

The TA-14 OB unit is covered with a tarp when not in use to minimize the potential for deterioration of the unit and prevent the accumulation of precipitation. Accumulation of precipitation would only occur while the OB unit is not covered during the cooling period after a burn; in such a case, the wet residual ash would be removed from the containment tray, placed in appropriate containers, and stored temporarily in a nearby satellite accumulation area.

LANL minimizes the impact to the environment by conducting treatment operations in strictly controlled, remote areas within the LANL boundaries. Residues (metallic shards and occasional pieces of propellants, explosives, or pyrotechnics) are managed in accordance with SOPs for the OB/OD units; the SOPs require a thorough survey of the area after each detonation and collection of all identifiable pieces of material not consumed by the detonation. Pieces not consumed are collected for detonation. Trained operators ensure that sufficient and appropriate initiating explosives are used so that these materials detonate rather than deflagrate. Any deflagrating material is carefully collected for detonation. Unexploded ordnance is not treated at the TA-14 OB/OD units.

4.6 ENVIRONMENTAL PERFORMANCE STANDARDS APPLICABLE TO MISCELLANEOUS TREATMENT UNITS [20 NMAC 4.1, Subpart V, Part 264, Subpart X]

The OB/OD thermal treatment units addressed in this Part B permit application are located in remote areas of LANL and will be operated, maintained, and closed in a manner that will ensure protection of human health and the environment, in accordance with 20 NMAC 4.1, Subpart V, 264.601, revised November 1, 1995. Geologic and hydrologic characteristics of the LANL facility and land use patterns in the Los Alamos area are discussed in Section 2.0 of the LANL General Part B.

The OB/OD thermal treatment units have been designed to facilitate safe handling and treatment of wastes in order to prevent adverse human health and environmental impacts. Design information and waste management practices for these units are detailed in Sections 4.1 through 4.5. The waste analysis plan for these units is included as Section 3.0 of this Part B permit application. A description of emergency response actions to be taken to minimize adverse impacts of unanticipated events are described in the contingency plan (see Section 7.0 of this document and Section 7.0 of the LANL General Part B).

SOPs are followed at the OB/OD thermal treatment units to minimize the potential for environmental contamination that may result from precipitation contacting treatment residues. Residues resulting from treatment activities may consist of metallic shards and occasional pieces of propellants, explosives, or pyrotechnics. SOPs for the OB/OD thermal treatment units require that the firing-site leader thoroughly survey the area after each detonation and collect all identifiable pieces of explosives. The damaged explosives are then weighed and an estimate of the amount of material remaining at the unit is recorded in the site record logbook. Every effort is made to minimize the quantity of explosive and nonexplosive residues remaining at a unit. SOPs that are applicable for access and operations at the OB/OD thermal treatment units described herein are included as Appendix B.

4.6.1 Protection of Groundwater/Vadose Zone [20 NMAC 4.1, Subpart V, 264.601(a)]

As required by 20 NMAC 4.1, Subpart V, 264.601(a), revised November 1, 1995, the OB/OD thermal treatment units addressed in this Part B permit application are located in remote areas and are operated in a manner that prevents releases that may have adverse affects to human health or the environment due to migration of waste constituents through the vadose zone to groundwater. The following sections provide information on the potential for adverse effects on human health or the environment as a result of operations at the OB/OD thermal treatment units as well as describe monitoring and reporting efforts that have been or will be undertaken to assess the impact of thermal treatment operations.

4.6.1.1 Hydrogeologic Assessment and Potential Pathways and Exposure Routes

Each of the OB/OD thermal treatment units addressed in this Part B permit application is located in a semiarid, temperate, mountain climate. The average annual precipitation in Los Alamos is 18.73 inches (LANL, 1996b). The evaporation rate of free standing water exceeds the average annual precipitation. Site-specific information for the soils at the OB/OD thermal treatment units, including permeability rates and available water-holding capacity, is provided in Section 2.2 of this Part B permit application. In addition, it is estimated that 600 to 1,200 feet of unsaturated tuff and volcanic rock separate the facility's soil surface from the main aquifer (Figure 2-7 in the LANL General Part B). Collectively, the depth to the uppermost aquifer and the annual moisture deficit significantly limit the potential for contaminants to migrate through the vadose zone to groundwater.

An evaluation of possible waterborne waste transport pathways for groundwater and their potential for migration is included as Attachment 4-1, which lists the possible contaminants of concern and shows their origin and nature.

The only aquifer in Los Alamos capable of municipal and industrial water supply is the main aquifer. No supply wells or test wells are located within the boundaries of TA-14, TA-15, TA-36, or TA-39 or within 3,500 feet of any of the OB/OD thermal treatment units described herein.

TA-14

A detailed description of the hydrogeologic characteristics immediately below the OB/OD units at TA-14 is not currently documented in published or internal reports. However, a conceptual hydrologic model of the area is presented in Section 3.5 of the "RFI Work Plan for Operable Unit 1085" (LANL, 1994a). Published precipitation data for TA-14 do not exist; however, a precipitation measurement site is located at TA-16, just south of and adjacent to TA-14, and annual precipitation at this site is 23.28 inches per year (LANL, 1996b). As stated above, no supply wells are located within 3,500 feet of any of the OB/OD units at LANL, and there are no supply wells located within the boundaries of TA-14. In addition, there are no supply wells located at TA-15, TA-36, and TA-39; these are the locations of the remaining OD units at LANL. Therefore, withdrawal rates are not applicable to any of the OB/OD units at LANL.

4.6.1.2 Monitoring and Reporting

LANL has established an extensive groundwater monitoring system to assess and protect the quality of groundwater in the Los Alamos area. The monitoring network includes test wells, supply wells, gaging stations, observation wells, and other hydrogeologic devices located both inside and outside LANL boundaries. Routine samples are analyzed for toxic constituents, basic water quality, and resource depletion. The results are published in the annual "Environmental Surveillance Report" and the annual "Water Supply Report." Details on the Environmental Surveillance Groundwater Monitoring Plan can be found in the "Groundwater Protection Management Program Plan" (LANL, 1995).

TA-14

The U.S. Army Environmental Hygiene Agency's "RCRA Part B Permit Writer's Guidance Manual for Department of Defense Open Burning/Open Detonation Units" (AEHA, 1987) states that "ground-water monitoring would only be required for OB units that burn directly on the ground without leak detection and containment systems" and that "OD units, where proper operational procedures are followed (particularly management of residuals), are exempt from the ground-water protection requirements" presented in the manual. It goes on to state that "ground-water monitoring at OD units was deemed to be both impractical and unnecessary." The OB unit's design prevents burning directly on the ground and the unit has a containment system. Proper operational procedures are followed at the TA-14 OD unit and materials not consumed in a detonation are collected for detonation. Together, the OB unit design and operation and the proper operating procedures at the OD unit meet the criteria for exemptions from groundwater monitoring.

NMED's August 17, 1995, letter to DOE/LAAO (see Appendix C of this document) required LANL to develop a RCRA site-wide hydrogeologic workplan and to submit this workplan to NMED and EPA for review and approval. Part of the workplan objective was to address RCRA groundwater monitoring requirements for regulated units; implementation of the plan will also provide information on the hydrology below the OB/OD units at TA-14. Because the workplan will address groundwater monitoring requirements and because its implementation will provide hydrologic information for TA-14, LANL wishes to defer to that plan where appropriate for relevant groundwater monitoring issues. NMED and LANL are currently addressing LANL's groundwater monitoring program and hydrogeologic characterization requirements under the "Hydrogeologic Workplan," submitted to NMED in December 1996 (LANL, 1996d).

The "Hydrogeologic Workplan" proposes the construction and subsequent sampling of 4 alluvial wells and 4 regional aquifer wells upgradient from, adjacent to, and downgradient from TA-14 in Cañon de Valle and in Water Canyon. Well installation will characterize the alluvial, intermediate perched, and regional aquifer zones for a more complete understanding of the hydrogeologic setting. However, the proposed iterative characterization and well installation process will incorporate new data with existing data as input to modeling activities and then be used to reassess additional data needs; therefore, it may be determined that one or more of the wells are not necessary. In any case, the general objectives of the 8 proposed wells near TA-14 are described in Sections 4.3.5.2 and 4.3.6.4 of the plan and are summarized herein.

The planned alluvial wells include A-45 and A-46 upgradient in Cañon de Valle, A-47 downgradient near the confluence of Cañon de Valle and Water Canyon, and A-48 further downgradient in Water Canyon. Alluvial wells A-45 and A-46 are proposed to confirm the presence of alluvial saturation, to measure the parameters in the alluvium that control contaminant migration, and to analyze the quality of the alluvial water. The well A-45 location is upgradient of LANL activities and will provide background water quality characteristics of the alluvial water. Well A-46 will identify the presence of alluvial water, and data from the well may be compared to that from well A-45 to assess impacts of operational practices upgradient from the OB/OD units at TA-14. Alluvial wells A-47 and A-48 are proposed to evaluate the presence of alluvial water and the possible migration of contaminants from Cañon de Valle into Water Canyon alluvium. Well A-47 will also be used to measure the saturated thickness, water quality, and parameters controlling infiltration and contaminant migration. Well A-48 will be used to determine the downstream extent of alluvial water.

The planned regional aquifer wells include R-24 and R-25 upgradient in Cañon de Valle, R-27 downgradient near the confluence of Cañon de Valle and Water Canyon, and R-28 further downgradient in Water Canyon. All of the regional aquifer wells will characterize the intermediate perched zone(s) as the wells are drilled. Well R-24 will be located near the trace of the Pajarito Fault system west of the LANL boundary. Its purpose will be to provide water quality on the upthrown block of a major splay of the fault system. Water level data from this well will be compared to similar data from well R-25 to evaluate the influence of the Pajarito Fault system on the regional aquifer piezometric surface and the role of the fault as a recharge zone for the regional aquifer. Water quality data from R-24 will define the expected background distribution of constituents upgradient from LANL operations. These background data will be used to estimate the impact of LANL operations and provide input data for geochemical and hydrological modeling of the groundwater systems. Well R-25 will be located adjacent to MDA P at TA-16, which is upgradient from the TA-14 OB/OD units. This well will provide needed regional aquifer water level and water quality information and water quality data for any intermediate perched zones encountered. Core will be collected from R-25 to support sitewide studies of the hydrogeologic framework and constrain geologic and hydrologic relationships in surrounding cored boreholes (e.g., wells R-24 and R-27). Data from wells R-24 and R-25 will also provide important information on flow conditions near the LANL boundary that will enhance groundwater flow modeling. Well R-27 will be located below the confluence of Water Canyon and Cañon de Valle, which is downgradient from the OB/OD units at TA-14. This well will be used to identify intermediate perched zones and the depth to the regional aquifer, and data from this well will be used to characterize the water quality of the intermediate perched zones and in the regional aquifer. Well R-28 will be located downgradient of well R-27. It will also be used to provide water quality information for any intermediate perched zones and the regional aquifer. As shown on Map 6 of the OB/OD Part A, there currently are no groundwater monitoring or test wells in the vicinity of TA-14. LANL has been working with HRMB to plan and develop a facilitywide groundwater program. The placement of a detection monitoring well(s), if deemed necessary, will be determined by implementation of the "Hydrogeologic Workplan." Well designs will follow specifications in Section 4.1.1 of the "Hydrogeologic Workplan." As presented in Sections 4.1.3 and 4.1.4 of the "Hydrogeologic Workplan," sample collection, preservation, shipment, QA/QC procedures, sampling and analysis procedures, data evaluation, and reporting will be conducted according to Environmental Restoration (ER) Project Quality Assurance Project Plans (QAPjP), SOPs, RFI Work Plans, and sampling and analysis plans (SAP). The parameters that will be analyzed for include those listed in Table 4-1. Monitoring well evacuation will be conducted in accordance with guidelines in EPA's "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986b). Currently, there are no wells in place near the OB/OD units at TA-14. The risk assessment conducted for TA-14 (see Appendix D of this document) concludes that after 40 years of operations at TA-14, the current level of contaminants for both surface soil and surface water does not pose a potential significant risk to human health. Therefore, it is highly unlikely that contaminants from previous OB/OD activities have migrated to the groundwater and created a plume of contamination. However, the "Hydrogeologic Workplan" described above will provide information on water quality in this area. Procedures to be followed for proposed sampling and analysis, statistical comparison procedures, and data evaluation will adhere to those contained in ER Project QAPjPs, SOPs, RFI Work Plans, and SAPs. Background groundwater values for barium and chromium will be collected from planned alluvial well A-45 and planned regional aquifer well R-24. These background data will be used to calculate a background mean and variance, per the guidance in Appendix IV of 20 NMAC 4.1, Subpart V, incorporating 40 CFR 264. According to current published reports, the direction of groundwater flow in the Los Alamos area is generally southeast, as shown on Figure 2-9 of the General Part B. The flow rate depends on which rock formation the groundwater is located in, as discussed in Section 2.2.5 of the General Part B. Data collected during activities performed for the "Hydrogeologic Workplan" will provide more detailed information on groundwater direction and flow rate, and on plume migration rate in case of groundwater contamination.

Previous hydrogeologic studies at LANL (IT Corporation, 1987) have shown that the combination of very low moisture content in the Bandelier Tuff, the empirical determination that moisture from precipitation does not infiltrate below a depth of 10 to 22 feet, and very low calculated flux rates all suggest that aqueous transport of contaminants through the tuff is not a viable mechanism for contaminant migration from mesatops. In addition, the "RFI Work Plan for Operable Unit 1085" (LANL, 1994a), which includes TA-14, does not consider the vadose zone to be a major exposure pathway for contaminant transport; the major pathways discussed therein include surface water runoff and soil/sediments in surrounding drainages. Furthermore, the risk assessment conducted for TA-14 concludes that after 40 years of operations at TA-14, the current level of contaminants for both surface soil and surface water does not pose a threat to human health. Therefore, rather than conducting vadose zone monitoring for the OB/OD units at TA-14, LANL proposes to first address surface systems (surface water, soil, and sediments) and use resulting surface systems analytical data in conjunction with existing data in an iterative manner to reassess additional data needs and thus optimize characterization and monitoring activities. Soil and sediment data will be collected as described in Section 4.6.3.2 for soil monitoring; surface water runoff data will be collected in accordance with the National Pollutant Discharge Elimination System Storm Water Permit for the site. This proposed iterative process is similar to the iterative characterization and well installation process proposed in the "Hydrogeologic Workplan" (LANL, 1996d). The purpose of the "Hydrogeologic Workplan" is to characterize the hydrogeologic setting beneath LANL; new data will be incorporated with existing data as input to modeling activities and will be used in an iterative manner in reassessing additional data needs. Similarly, the proposed iterative process for the OB/OD units at TA-14 will allow technical prudence by first addressing the surface systems; proceeding with vadose zone monitoring would then be conducted only if continuing reassessments indicate a need, depending on the interpretation of the surface data. If surface sampling data indicate that RCRA contaminants resulting from OB/OD treatment are present and if the mobility of these contaminants so warrants, a vadose zone monitoring program will then be established and conducted.

4.6.2 Protection of Surface Water/Wetlands [20 NMAC 4.1, Subpart V, 264.601(b)]

As required by 20 NMAC 4.1, Subpart V, 264.601(b), revised November 1, 1995, the OB/OD thermal treatment units addressed in this Part B permit application are located in remote areas and are operated in a manner that prevents any releases that may have adverse affects on human health or the environment due to migration of waste constituents to surface waters or wetlands. The following sections provide information on the potential for adverse effects to human health or the environment as a result of operations at the OB/OD thermal treatment units as well as describe monitoring and reporting efforts that have been or will be undertaken at each of the units to assess the impact of operations.

4.6.2.1 Hydrologic Assessment and Potential Pathways and Exposure Routes

Net annual precipitation for the Los Alamos area, including the sites of the OB/OD thermal treatment units, is low. In addition, surface waters within LANL are limited to ephemeral, interrupted, or intermittent flows in the canyon bottoms that result from rainfall or snowmelt. The locations of these surface waters, including intermittent streams, are shown on Map 6 of the OB/OD Part A (LANL, 1997). Drainage from the TA-14, TA-15, and TA-36 sites flows into nearby canyons. Both of the TA-39 sites are located in a canyon bottom.

Canyon bottom surface waters downstream of the firing sites at TA-14, TA-15, and TA-36 eventually flow into Water Canyon, and canyon bottom surface waters downstream of the TA-39 firing site eventually flow into Ancho Canyon. A gaging station in Water Canyon, located about 2.5 miles upstream of the Rio Grande, recorded a maximum discharge of 0.21 cubic feet per second in the 1995 water year. There was no flow most of the time (LANL, 1996b). Gage ratings for a gaging station in Ancho Canyon, located about 2 miles upstream of the Rio Grande, are to be established.

The OB/OD thermal treatment units included in this Part B permit application are a part of LANL's National Pollutant Discharge Elimination System (NPDES) General Permit for storm water discharges associated with industrial activity (Permit Number NMR00A384). A Storm Water Pollution Prevention (SWPP) Plan, as required by the NPDES General Permit, has been developed for the OB/OD thermal treatment units. The plan is designed to identify any potential pollutants and to provide pollution prevention or control methods to prevent the discharge of pollutants in storm water runoff at the unit and the surrounding area. Under the SWPP Plan, the facility is required to implement best management practices to reduce the likelihood of pollutants entering the storm water discharges. To this end, the following practices have been adopted at each of the OB/OD thermal treatment units:

Good Housekeeping

- Regular maintenance of the area is performed to ensure that it is clean and orderly
- SOPs have been written specifying proper waste handling to minimize the exposure of waste and waste residues to precipitation
- Regular inspections of the area are performed to ensure SOPs are being followed

Spill Prevention and Response

- Personnel are trained in material handling and release notification procedures

Visual Inspections

- Pollution prevention personnel inspect and log information concerning site drainage, erosion, non-storm-water discharges, and changes in adjacent facilities that may affect the potential for storm water pollution.

Under the NPDES General Permit, the measures described in Attachment 4-2 also apply to each of the OB/OD thermal treatment units.

An evaluation of possible waterborne waste transport pathways for surface water and their potential for migration is included as Attachment 4-1, which lists the possible contaminants of concern and shows their origin and nature.

TA-14

Surface waters in the vicinity of the OB/OD thermal treatment units at TA-14 are limited to ephemeral streams in the bottoms of canyons near the site, namely, Cañon de Valle, and Threemile and Pajarito Canyons. Cañon de Valle lies approximately 1,000 feet due south of the TA-14 OB/OD thermal treatment units; Threemile Canyon is roughly 2,000 feet northeast of the units; and Pajarito Canyon is situated approximately 3,000 feet to the north. According to the "RFI Work Plan for Operable Unit 1085" (LANL, 1994a), drainages from the central part of TA-14, including the TA-14 OB/OD thermal treatment units, flow only into Cañon de Valle. If water volume is sufficient, flow from this canyon may reach the Rio Grande.

Contaminants that may potentially be released from TA-14 OD operations may include residual explosives, barium, chromium, or non-halogenated solvents. Potential contaminants from the TA-14 OD thermal treatment unit may reach nearby surface waters in one or more of the following ways: (1) direct (airborne) deposition from OD operations; (2) transport by surface water runoff; and (3) wind erosion and deposition of contaminated soils.

Potential contaminants resulting from OB operations at TA-14 may include the following: carbon monoxide (CO), nitrogen oxides (NO_x), methane, ammonia, hydrogen cyanide, sulfur oxides, particulates, and volatile organic compounds (VOC). With the exception of particulate material (i.e., ash), each of these potential contaminants is either a gas or has a relatively high vapor pressure and, thus, would not be expected to contaminate surface waters.

TA-15

The TA-15-184 OD thermal treatment unit is bordered by Potrillo Canyon to the north and Water Canyon to the south. Waters from both of these canyons flow into the Rio Grande. The stream flow in Potrillo Canyon is ephemeral and occurs only as the result of rainfall or snow melt. Water Canyon may receive flow from Cañon de Valle. Contaminants that may potentially be released from the TA-15 OD thermal treatment unit may include beryllium or lead (LANL, 1994c). These contaminants may reach nearby surface waters in one or more of the following ways: (1) direct (airborne) deposition from OD operations; (2) transport by surface water runoff; and (3) wind erosion and deposition of contaminated soils. The nature and extent of contamination at the TA-15-184 firing site is described in Section 4.6.3.1.

TA-36

The TA-36-8 OD thermal treatment unit is located in the vicinity of the headwaters of Fence Canyon. Fence Canyon waters flow into Potrillo Canyon and then into Water Canyon, which eventually flows into the Rio Grande. The stream flow in Fence Canyon and Potrillo Canyon is ephemeral and occurs only as the result of rainfall or snow melt. A discharge sink, which is geomorphologic feature, has been identified in Potrillo Canyon. The discharge sink absorbs stream flow and traps incoming sediments. Immediately downstream from the sink, there is no evidence of stream flow. It is suspected that surface waters generated from the watershed upstream of the sink do not reach the Rio Grande (LANL, 1993b).

Contaminants that may potentially be released from the TA-36 OD thermal treatment unit are likely to include residual explosives or lead (LANL, 1994d). These contaminants may reach nearby surface waters in one or more of the following ways: (1) direct (airborne) deposition from

OD operations; (2) transport by surface water runoff; and (3) wind erosion and deposition of contaminated soils. The nature and extent of contamination at the TA-36 firing site is described in Section 4.6.3.1.

TA-39

The firing sites at TA-39 are located in the bottom of Ancho Canyon and are in close proximity to intermittent streams located there. If the water volume is sufficient, these flows may reach the Rio Grande approximately three miles away. Contaminants that may potentially be released from the TA-39 OD thermal treatment units may include residual explosives or lead (LANL, 1994e; LANL, 1994f). These contaminants may reach nearby surface waters in one or more of the following ways: (1) direct (airborne) deposition from OD operations; (2) transport by surface water runoff; and (3) wind erosion and deposition of contaminated soils. The nature and extent of contamination at the TA-39 firing site is described in Section 4.6.3.1.

4.6.2.2 Monitoring and Reporting

Under the current NPDES General Permit, surface water monitoring is not required at these sites. The General Permit expires in October of 1997, and an application for coverage of these sites under the next tier, the Multi-Sector General Permit, will be submitted. The following paragraphs detail surface water reporting and proposed monitoring strategies for the units addressed in this Part B permit application in accordance with the requirements in 20 NMAC 4.1, Subpart V, 264.602, revised November 1, 1995.

TA-14

Water quality standards are contained in 20 NMAC 6.1, effective January 23, 1995. General standards that apply to LANL are contained in 20 NMAC 6.1, Section 1102. Surface water runoff sampling was conducted downslope of the OB/OD units during the summer of 1995 to quantify the concentrations of potential hazardous constituents. Gas chromatography/mass spectrometry results showed no detectable amounts of volatile and semivolatile organic compounds. Graphite furnace atomic absorption spectroscopy results for metals showed the following: barium, 120 μg/L; beryllium, 3 μg/L; cadmium, 1.0 μg/L; chromium, 5.8 μg/L; and lead, 11 μg/L (see QEW-1 data in Appendix E of this document). As stated above, surface waters in the vicinity of the OB/OD units at TA-14 are limited to ephemeral streams in Cañon de Valle; thus, these surface waters do not provide municipal or industrial water supply. Under LANL's NPDES permit

Compare to background

issued August 1, 1994, water uses include livestock and wildlife watering. Wildlife habitat standards are contained in 20 NMAC 6.1, Section 3101, Paragraph L. Future surface water monitoring will be conducted in accordance with the NPDES Storm Water Permit for the site.

In order to maintain compliance with the NPDES General Permit, annual site inspections are conducted at TA-14 to evaluate the effectiveness of the SWPP Plan. The inspections are documented in an inspection report that describes any major observations, incidents of noncompliance with the SWPP Plan, corrective actions, and any observations or changes made with respect to the SWPP Plan.

TA-15

In order to maintain compliance with the NPDES General Permit, annual site inspections are conducted at TA-15 to evaluate the effectiveness of the SWPP Plan. The inspections are documented in an inspection report that describes any major observations, incidents of noncompliance with the SWPP Plan, corrective actions, and any observations or changes made with respect to the SWPP Plan.

According to the "RFI Work Plan for Operable Unit 1086" (LANL, 1993a), the TA-15-184 firing site has met the recommended criteria as a potential release site for which corrective actions are to be deferred until the site is decontaminated and decommissioned. Available information has shown that there is no current health risk to site workers and that hazardous material is not migrating off LANL property. Details on the criteria for this recommendation can be found in the work plan.

TA-36

In order to maintain compliance with the NPDES General Permit, annual site inspections are conducted at TA-36 to evaluate the effectiveness of the SWPP Plan. The inspections are documented in an inspection report that describes any major observations, incidents of noncompliance with the SWPP Plan, corrective actions, and any observations or changes made with respect to the SWPP Plan.

The "RFI Work Plan for Operable Unit 1130" (LANL, 1993b) proposes collecting water and sediment samples from sediment catchment areas identified in Fence, Potrillo, and Water

Canyons. The sampling will be conducted to determine contaminant redistribution via surface water runoff. The water samples will be collected in accordance with LANL-ER-SOP-06.13, "Surface Water Sampling" (LANL, 1992a). Quality assurance/quality control (QA/QC) samples will be collected and analyzed in accordance with LANL's Environmental Restoration Program Generic Quality Assurance Project Plan (LANL, 1991).

TA-39

In order to maintain compliance with the NPDES General Permit, annual site inspections are conducted at TA-39 to evaluate the effectiveness of the SWPP Plan. The inspections are documented in an inspection report that describes any major observations, incidents of noncompliance with the SWPP Plan, corrective actions, and any observations or changes made with respect to the SWPP Plan.

The "RFI Work Plan for Operable Unit 1132" (LANL, 1993c) proposes immediate (i.e., before unit decommissioning) field sampling at and around the active firing sites at TA-39 to characterize the extent of contamination. The primary impetus for conducting field sampling immediately is to evaluate whether contaminants are moving off site. A geomorphic characterization will be conducted prior to field screening and sampling. This characterization will identify major landform features, stream channels, drainage patterns, and sites of active erosion (LANL, 1993c).

A field radiation survey and a field metals survey (using x-ray fluorescence instrumentation) will be conducted prior to actual sampling. These surveys will be conducted on 10- by 10-foot grids within a 100 foot radius of the center of each firing pad and will include the adjacent stream channels (LANL, 1993c). Samples will then be collected from the stream channels adjacent to the OD thermal treatment units based on the information provided by the geomorphic characterization. In addition, to determine whether contaminants have been transported to the flood plain channel downstream from the OD thermal treatment units, the canyon bottom will be sampled in three locations (LANL, 1993c). Samples will be analyzed for explosives, polychlorinated biphenyls (PCB), SVOCs, petroleum hydrocarbons, metals, cyanide, and radiological analytes (i.e., gamma radiation, uranium, thorium). If it is determined that contamination exists, additional sampling will be performed to establish a more detailed analysis of contaminant distribution and transport pathways (LANL, 1993c).

4.6.3 Protection of Soil Surface [20 NMAC 4.1, Subpart V, 264.601(b)]

As required by 20 NMAC 4.1, Subpart V, 264.601(b), revised November 1, 1995, the OB/OD thermal treatment units addressed in this Part B permit application are located in remote areas and are operated in a manner that minimizes or prevents releases that may have adverse affects to human health or the environment. The following sections provide information on the potential for adverse effects to human health or the environment as a result of operations at the OB/OD thermal treatment units as well as describe monitoring and reporting efforts that have been or will be undertaken at each of the units to assess the impact of operations at the units.

4.6.3.1 Geologic Assessment and Potential Pathways and Exposure Routes

The texture of the soils in Los Alamos County range from very fine clay and sandy loams to gravelly, sandy loams and stony, clay loams. Soil erosion by storm water or winds could potentially transport contaminants from the OB/OD thermal treatment units to surrounding areas. Natural sediment storage features created by surface water runoff, such as stream bank and bar deposits or drainage channels, could contain heavy metals or explosives residues redistributed from the OB/OD thermal treatment units.

SOPs for the units have been developed and are followed to limit the amount of contamination that may enter or remain in the soil after a detonation. Preventative measures include good housekeeping procedures and using a sufficient charge to ensure complete destruction and effective treatment of the explosives.

TA-14

In June 1993, soil, sediment, and rinsate sampling was performed at the TA-14 firing sites, including the Firing Mound 3 area near TA-14-23. Samples were laboratory-analyzed for TCLP metals, total metals (beryllium, lead, and mercury), VOCs, SVOCs, and explosives residues. The results of the 1993 soil sampling are presented in Attachment 4-3; the analytical results (raw data) are included in Appendix F (note: a typographical error in a LANL memo incorrectly stated the building number [Building 35]; the actual building number is Building 23). Potential contamination is believed to be limited to the surface (i.e., the first few inches) of the site. Potential contaminants from OB operations are not likely to impact soils in the area, as supported by the baseline human health and ecological risk assessment conducted for TA-14 (see Section 4.12 and Appendix D).

TA-15

In April 1993, soil, sediment, and rinsate samples were collected in the vicinity of TA-15-184. Samples were laboratory-analyzed for TCLP metals, total metals (beryllium, lead, and mercury), VOCs, SVOCs, and explosives residues. The results of the 1993 soil sampling survey are summarized in Attachment 4-4 of this section. Potential contamination is believed to be limited to the surface (i.e., the first few inches) of the site.

TA-36

In August and September of 1992, soil, sediment, and rinsate samples were collected from the TA-36-8 OD area. Samples were laboratory-analyzed for TCLP metals, total metals (beryllium, lead, and mercury), VOCs, SVOCs, and explosives residues. The results of the 1992 soil sampling surveys are summarized in Attachments 4-5 and 4-6 of this section. Potential contamination is believed to be limited to the surface (i.e., the first few inches) of the site.

TA-39

It is anticipated that widespread contamination exists on and around the firing sites at TA-39 and that contaminant transport is active and ongoing. Potential contamination is likely to be limited to the surface (i.e., the first few inches) of the site. Ingestion or dermal contact with the soil on site may pose health risks to the operators of the unit, damage to wildlife that live at the site, and damage to the surrounding vegetation. In addition, contaminated soils/sediments may have been carried via surface water runoff to adjacent stream channels, nearby canyons, and possibly to the Rio Grande.

In March 1993, soil, sediment, and rinsate samples were collected from the TA-39-6 and TA-39-57 OD areas. Samples were analyzed for TCLP metals (i.e., arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), total metals (lead, mercury, and beryllium), SVOCs, VOCs, and explosives residues. The results of the 1993 soil sampling at TA-39 are summarized in Attachments 4-7 and 4-8.

4.6.3.2 Monitoring and Reporting

The following paragraphs detail soil monitoring efforts that have been or are scheduled to be performed at the units addressed in this Part B permit application in accordance with the requirements in 20 NMAC 4.1, Subpart V, 264.602, revised November 1, 1995.

TA-14

LANL proposes the following Soil Monitoring Program as the preferred approach to meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602. Details of the proposed Soil Monitoring Program are presented below.

Annual Soil Sampling/Risk Assessment Approach. This approach for a Soil Monitoring Program will require one soil sampling event during the first year of the program, and using the data collected as additional input to the baseline risk assessment conducted for TA-14. The baseline risk assessment concludes that, after 40 years of operations at TA-14, the current level of contaminants for both surface soil and surface water does not pose a potential significant risk to human health. In addition, the overall ecological risks at the site are expected to be low. The annual soil sampling/risk assessment approach will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602 and ensure protection of human health and the environment. After the samples have been analyzed and the additional risk assessment is conducted, LANL proposes to meet with NMED to determine a reasonable schedule for potential additional activities using the risk assessment approach for the Soil Monitoring Program.

For the annual soil sampling/risk assessment approach, 10 soil samples will be collected from the area of the OB/OD treatment units during a single sampling event the first year of the Soil Monitoring Program. For the combined OB/OD area, LANL personnel will collect 10 discrete (non-composited) samples. One sample will be collected from approximately the center of the OD area and 5 equally spaced samples will be collected along a circle with a radius of approximately 100 feet from the center of the OD area (for a total of 6 samples for the OD area). Four discrete samples equally spaced along a circle with a radius of approximately 15 feet will also be collected in the OB area.

Sample collection, preservation, shipment, and chain-of-custody procedures and sampling and analysis procedures are discussed below.

LANL and NMED have discussed a Soil Monitoring Program based on a quarterly sampling approach; as an alternative, however, LANL evaluated the two approaches described herein. The evaluation concludes that, while both approaches will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602 and ensure protection of human health and the environment, the annual soil sampling/risk assessment approach is LANL's preferred approach because it also allows technical prudence and, most importantly, is a fiscally responsible alternative approach. LANL estimates that the expense of implementing this cost-effective alternative approach (including sampling, analysis, surveying, and the additional risk assessment) will be approximately one third the amount of implementing the quarterly sampling approach, described below.

Quarterly Sampling Approach. This approach for a Soil Monitoring Program will require that soil samples be collected within 30 days following each OB/OD treatment operation, with a maximum sampling frequency of once every three months (i.e., quarterly). Data collected would be evaluated using Cochran's Approximation to the Behrens-Fisher Students' t-test discussed below. The quarterly sampling approach will meet the monitoring and analysis requirements of 20 NMAC 4.1.500 incorporating 40 CFR 264.602 and will ensure protection of human health and the environment; however, the estimated cost may exceed 3 times the cost of the risk assessment approach. After 1 year of quarterly sampling (if this approach is selected), LANL proposes to meet with NMED to evaluate the quarterly sampling approach to the Soil Monitoring Program to determine if the quarterly sampling frequency may be justifiably decreased (e.g., if the sampling data indicate no significant adverse effects to human health and the environment as a result of treatment activities).

For the OD area, LANL personnel will collect 5 discrete samples. One sample will be collected from approximately the center of the OD area and 4 equally spaced samples will be collected along a circle with a radius of approximately 100 feet from the center of the OD area. For the OB area, LANL personnel will collect 4 discrete samples equally spaced along a circle with a radius of approximately 15 feet from the OB unit.

Procedures. Each discrete sample will be placed in a labeled glass sample container. To ensure that representative discrete soil samples are collected, all soil sampling activities will be conducted in accordance with the LANL Hazardous and Solid Waste Group (ESH-19) Sampling and Analysis Plan (SAP).

Protective gloves will be worn during soil sampling activities and the spade and scoop method will be used by LANL personnel collecting samples. Sample containers will be labeled with the date, time, exact sampling location, and the name of the individual collecting the sample. For any sampling event, a field duplicate soil sample will be collected from one of the sample locations and analyzed to assess laboratory quality control. The field duplicate will be collected and handled in the same manner as the field samples. In addition, a trip blank and a field blank will be collected for each sampling event, as appropriate. Following the collection of each sample, the disposable scoops used will be containerized and stored appropriately, pending receipt of analytical results. Therefore, equipment rinsate blanks will not need to be collected.

Following each soil sampling event, LANL personnel will transport the field and QC samples to LANL's High Explosives Science and Technology Group (DX-2) for explosives analysis, to LANL's Organic Analysis Group (CST-12) for organics analysis, and to LANL's Inorganic Trace Analysis Group (CST-9) for metals analysis, or will arrange for transport to LANL-approved off-site analytical laboratories. Samples will be transported to the respective analytical laboratories in a timely manner to ensure that sample holding times specified in the U.S. Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (*SW-846*) (EPA, 1986a) are met. In addition, samples will be preserved, as appropriate, as specified in *SW-846*. At the time of sample collection, sample collection personnel will complete chain-of-custody forms and will place custody tape on all sample containers to ensure that sample custody is maintained. Sample collection personnel will maintain physical custody of the samples until the samples are relinquished to laboratory personnel. Upon receiving the soil samples, the laboratory technician will assume custody of the samples, noting the date, time, and name of the person relinquishing custody of the samples to the laboratory.

The analytical parameters, EPA Hazardous Waste numbers, rationale for parameter selection, and EPA *SW-846* analytical methods to be used for the samples collected as part of the Soil Monitoring Program for the TA-14 OB/OD units are presented in Table 4-1.

Because explosives and the two volatile organic compounds proposed for monitoring are not naturally occurring, background values for these compounds will likely be below instrument detection limits. The background concentrations of the metals proposed for monitoring (barium [from the explosives] and chromium [from the detonator caps]) were estimated using data collected as part of LANL's Environmental Surveillance Program; these existing data include a number of on-site (within LANL boundaries) and off-site perimeter (within approximately 5 kilometers of LANL boundaries) sample locations. The values given in Table 4-2 represent the average concentrations of samples collected at the 16 on-site and off-site perimeter locations during 1995 (LANL, 1996b). The background sample data and locations are provided in Appendix G of this document. If the quarterly sampling approach to the Soil Monitoring Program is implemented, these data will be supplemented with data obtained from the "area-specific" background samples to be collected as described below; all of the background data will be used to calculate a background mean and variance, per the guidance in Appendix IV of 20 NMAC 4.1, Subpart V, incorporating 40 CFR 264.

If the quarterly sampling approach to the Soil Monitoring Program is implemented, the statistical analysis to be used in the interpretation of analytical data will be Cochran's Approximation to the Behrens-Fisher Students' t-test in Appendix IV of 20 NMAC 4.1, Subpart V, incorporating 40 CFR 264. This method of statistical analysis will be performed by LANL to identify statistically significant differences between background mean and background variance. If at any time during the permitted life of the OB/OD units, analysis reveals statistically significant differences between background concentrations and waste constituent concentrations attributable to OB/OD treatment operations, LANL will notify NMED in writing. However, after one year of performing quarterly soil sampling (if this approach is implemented), LANL proposes to meet with NMED to evaluate the Soil Monitoring Program and to determine if the quarterly sampling frequency may be justifiably decreased (e.g., if the sampling data indicate no significant adverse effects to human health and the environment as a result of treatment activities).

In addition to the background soil data presented in Table 4-2, four "area-specific" background soil samples will be collected at TA-14 and analyzed for barium and chromium. The area-specific background soil samples will be collected only if the quarterly sampling approach is implemented. These additional background soil samples will be collected from a distance of 750 to 1250 feet to the north, east, west-northwest, and northeast of the OB/OD area. The proposed distances will allow samples to be collected beyond the hazard zone yet within the flatter regions of the mesatop. (Note: A canyon located approximately 600 feet south of the units prevents the collection of a background sample from the area 750 to 1250 feet due south of the units). All background samples will be collected from the 0 to 6-inch depth interval.

TA-15

A corrective action program will be conducted at the TA-15-184 OD thermal treatment unit to determine if hazardous constituents may be migrating off site. The study will evaluate samples for TCLP metals, beryllium, SVOCs, and explosives.

TA-36

The "RFI Work Plan for Operable Unit 1130" (LANL, 1993b), which includes the area encompassing the TA-36-8 OD thermal treatment unit, proposes conducting a geomorphic survey along Fence, Potrillo, and Water Canyons. The survey will identify sediment catchment areas and establish locations where sediment sampling will occur. Surface sediment samples will be collected from areas in all three canyons from depths of 0 to 6 inches. Sediment samples will be collected in accordance with LANL-ER-SOP-06.09, "Spade and Scoop Method for Collection of Soil Samples" (LANL, 1992b).

TA-39

The proposed field sampling effort for the TA-39 firing sites is described in Section 4.6.2.2 of this permit application. In addition, soil samples will be collected from each firing pad, from adjacent hill slopes, and from adjacent mesa tops. Four surface soil samples will be collected at each of the firing pads. Surface and subsurface (i.e., 10 inches below surface) soil samples will be collected at 150-foot intervals along predetermined transects on the adjacent hill slopes and mesa tops (LANL, 1993c). Samples will be analyzed for explosives, PCBs, SVOCs, petroleum hydrocarbons, metals, cyanide, and radiological analytes (i.e., gamma radiation, uranium, thorium).

4.6.4 Protection of the Atmosphere [20 NMAC 4.1, Subpart V, 264.601(c)]

As required by 20 NMAC 4.1, Subpart V, 264.601(c), revised November 1, 1995, the OB/OD thermal treatment units addressed in this Part B permit application are located in remote areas within LANL boundaries and are operated in a manner that prevents any releases that may have adverse affects to human health or the environment due to migration of waste constituents to the atmosphere. The following sections provide information on the potential for adverse effects to human health or the environment as a result of operations at the OB/OD thermal treatment units as well as describe monitoring and reporting efforts that have been or will be undertaken at each unit to assess the impact of operations at the units.

4.6.4.1 Meteorologic Assessment and Potential Pathways and Exposure Routes

Surface winds in Los Alamos are light, averaging seven miles per hour. The predominant prevailing wind direction is from the southwest to the northeast. Under normal conditions, resuspension of particulates is limited. Detailed information on winds in Los Alamos is provided in Section 2.1.4 of the LANL General Part B. In addition, the LANL General Part B presents information on wind roses for the Los Alamos area in Section 2.1.4 and on Figures 2-3 and 2-4.

By definition, OD units do not utilize air pollution control equipment. Releases resulting from the treatment of waste at the OD thermal treatment units are not likely to exceed a maximum exposure duration of 15 minutes and would most likely be a one-time exposure for any individual receptor. Various types of explosives mixtures are treated at the OD thermal treatment units. The regulated pollutants produced as a result of these detonations are the criteria pollutants (e.g., CO, NO_x, and particulate matter), some heavy metals (e.g., lead), and a small amount of hazardous air pollutants (HAPs - e.g., hydrogen chloride [HCl], hydrogen fluoride [HF]).

An EPA-type gaussian plume model was employed with a puff type release function to simulate the airborne release resulting from the TA-36 thermal treatment unit. The worst-case waste treatment and receptor location were used in the scenario (i.e., a 2,000-lb treatment). Release heights and release fractions for a detonation cloud resulting from a typical 50-lb explosive detonation were determined. Airborne effluents were assumed to be transported directly to the potential receptors, using median dispersion factors for the Los Alamos area. Source terms or the pollutants generated during treatment activities were estimated using published emission factors (AP-42, developed by EPA), mass balance calculations, process knowledge, and engineering estimates. Impacts were evaluated for pollutants generated as a result of treatment and regulated under National and New Mexico Ambient Air Quality Standards. The results of this analysis indicate that none of the regulated air contaminant concentrations exceed federal or state ambient air quality standards.

4.6.4.2 Monitoring and Reporting

The following paragraphs detail atmospheric monitoring efforts that have been or are scheduled to be performed at the units addressed in this Part B permit application, in accordance with the requirements in 20 NMAC 4.1, Subpart V, 264.602, revised November 1, 1995.

TA-14

Air quality impact modeling, provided as Attachment 4-9 of this document, shows that a worst-case scenario using 100 times the allowable volume capacity of the OD unit at TA-14 resulted in concentrations far below the ambient air quality standards. Air quality impact modeling, provided in Table 9 of Appendix H of this document, for the OB unit at TA-14 also resulted in concentrations below the ambient air quality standards. In addition, the National Park Service, NMED, and LANL all agreed in 1994 that the low levels of ambient air criteria pollutants measured over a three-year period at the site of the nearest receptor did not warrant further ambient air monitoring. Therefore, ambient air quality monitoring is not warranted at the TA-14 OB/OD units.

TA-15

Air samplers and other means for detecting airborne contaminants have been deployed at the TA-15 OD thermal treatment unit. Data collected from these measurement devices have indicated that only small amounts of contaminants are aerosolized. The maximum amount of beryllium aerosolized is estimated at 2 percent. Efforts are currently underway to repeat this study and gain additional sampling data for this unit.

TA-36

The "RFI Work Plan for Operable Unit 1130" (LANL, 1993b) proposes field screening to predict potential hazards and health and safety conditions for on-site workers at the TA-36-8 firing site. The plan suggests using a portable flame ionization detector and/or photoionization detector to screen for VOCs. Field-screening data are not yet available.

TA-39

Atmospheric monitoring efforts to detect airborne contaminants at TA-39 have not yet been established.

4.6.4.3 Operating Conditions/Effectiveness and Reliability of Systems and Structures

TA-14

Operating conditions for the TA-14 OB unit include removing ash residue after a safe period of time (approximately 24 hours) and then covering the OB unit with a tarp; accepting only 50 pounds of combustibles per burn, which is the maximum allowable quantity of waste for this unit; transporting waste to the OB unit on the day of the treatment; conducting only one burn per day due to the 24-hour post-burn waiting period; and not conducting burning operations during adverse weather conditions (e.g., electrical storms, high winds). OB operations are postponed if the mean wind speed is equal to or greater than 10 meters per second, atmospheric stability conditions are unsuitable, and/or the mixing depth is less than 200 meters (see Appendix I of this document). Operating conditions for the OD unit include not conducting detonation operations during adverse weather conditions (e.g., electrical storms, high winds); accepting only 20 pounds of waste explosives per detonation, which is the maximum allowable quantity of waste for this unit; and transporting wastes to the OD unit on the day of the treatment. Beginning in 1990, NMED operated the LANL-owned criteria pollutant (ambient air) monitoring station at TA-49, adjacent to Bandelier National Monument and approximately 10,000 feet SSE of TA-14. The original purpose of this site was to collect baseline data for Bandelier National Monument over a three-year period. In 1994, the National Park Service, NMED, and LANL all agreed that the original purpose of the study was fulfilled and that the low levels of pollutants measured did not warrant further study at the site. Therefore, the ambient air monitoring was discontinued on September 30, 1994. Because the measured pollutants are so low and because air quality impact modeling results do not indicate the need (see below), ambient air monitoring is not conducted at TA-14. The closest meteorological monitoring station is located at TA-6, approximately 1 mile north of TA-14. Wind speed data are available from this station. By definition (see 20 NMAC 4.1.101 incorporating 40 CFR §260.10), "open burning means the combustion of any material <u>without</u> ... control of emissions of the gaseous combustion products." As such, emissions of hazardous constituents to the air are not prevented; however, the burn cage is operated with a wire mesh cover during treatment operations to reduce the potential for releases of burning particles to the environment. Air quality impact modeling was performed assuming a worst-case waste treatment and receptor location for open detonation; results of this modeling are provided in Attachment 4-9 of this document. Air quality impact modeling was also performed for the TA-14 OB unit; results of this modeling are provided in Table 9 of Appendix H of this document. Ambient air sampling is not conducted at the site because the air quality impact modeling results for the OB unit at TA-14 and for a worst-case OD scenario do not support the need for ambient air sampling.

4.7 OPERATING REQUIREMENTS [20 NMAC 4.1, Subpart VI, Subpart P]

In accordance with the requirements specified in 20 NMAC 4.1, Subpart VI, 265.373, revised November 1, 1995, an entire thermal cycle will be completed for treatment of hazardous waste at each thermal treatment unit (i.e., a noncontinuous [batch] thermal treatment process).

As required in 20 NMAC 4.1, Subpart VI, 265.382, revised November 1, 1995, OD of wastes at any of the OD thermal treatment units will be conducted in a manner that does not threaten human health or the environment. A minimum required distance of 1,750 feet will be maintained between the point of detonation and the property of others.

4.8 TREATMENT EFFECTIVENESS [20 NMAC 4.1, Subpart IX, 270.23(d)]

To address the applicable miscellaneous unit requirement specified in 20 NMAC 4.1, Subpart IX, 270.23(d), revised November 1, 1995, a demonstration of treatment effectiveness must be included for the OB/OD thermal treatment units addressed in this Part B permit application. As indicated in the U.S. Army Environmental Hygiene Agency (AEHA) guidance document titled "RCRA Part B Permit Writer's Guidance Manual for Department of Defense Open Burning/Open Detonation Units" (AEHA, 1987), a demonstration of treatment effectiveness can be based on laboratory or field data. For wastes treated by OD, data demonstrating that any residues or fragments remaining after the detonation are not reactive (i.e., as defined by the Resource Conservation and Recovery Act) should be provided. If any waste remains, it is treated again. The areas are visually inspected and explosive remnants are burned in place in conjunction with safety practices and SOPs.

4.9 IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES [20 NMAC 4.1, Subpart V, 264.17(a)]

Applicable requirements for the management of ignitable, reactive, and incompatible wastes will be met at the OB/OD thermal treatment units addressed in this Part B permit application. Pursuant to the requirements of 20 NMAC 4.1, Subpart IX, 270.14(b)(9), revised November 1, 1995, a description of the precautions exercised by personnel at the units to prevent accidental ignition or reaction of ignitable, reactive, or incompatible wastes is included in Section 5.0 of this Part B permit application.

4.10 INSPECTION [20 NMAC 4.1, Subpart V, 264.15]

In accordance with the requirements of 20 NMAC 4.1, Subpart V, 264.15, revised November 1, 1995, each of the OB/OD thermal treatment units will be inspected daily when in use (i.e., when wastes are managed at the unit) and weekly when not in use. Inspection parameters are specified in Section 6.0 of this Part B permit application and in Section 6.0 of the LANL General Part B. Inspection records will be maintained by responsible personnel and a copy of the record will be sent weekly, as appropriate, to LANL's Hazardous and Solid Waste Group.

4.11 RECORDKEEPING AND REPORTING REQUIREMENTS [20 NMAC 4.1, Subpart V, Part 264, Subpart E]

The various recordkeeping and reporting requirements applicable to all waste management units at LANL and addressed in this Part B permit application are detailed in Section 4.1 of the LANL General Part B.

4.12 RISK ANALYSIS

4.12.1 TA-14

An evaluation of human health risks was conducted and included a complete description of available on-site analytical data and off-site modeled concentrations (including those for air, surface water, and soil). This evaluation also included an exposure assessment (with potential receptors and complete exposure pathways), a toxicity assessment, and a risk characterization which, together, assess the potential cumulative impact on human health and the environment. The evaluation of human health risks is included in Appendix D of this document, and includes both hazard quotients and incremental lifetime cancer risks. An estimate of the individual excess lifetime cancer risk is summarized in Table 3-4 of Appendix D. The potential receptors at TA-14 include residential, occupational, and recreational. An evaluation of complete and incomplete exposure pathways for each of the potential receptors is also presented in Appendix D of this document. For OB/OD operations at TA-14, the primary receptor is an on-site worker.

An evaluation of ecological pathways and predicted risk is presented in Appendix D of this document. The ecological receptors selected include: a non-specific perennial plant, vagrant vole (insectivore), western harvest mouse (omnivore), Montane vole (herbivore), gray fox (omnivore), American kestrel (insectivore), and Mexican spotted owl (carnivore). Using the 95 percent upper confidence limit of the mean concentration, potential ecological risk was only predicted for the mouse, vole, and fox exposed to HMX, RDX, and TNT; and the kestrel exposed to bis(2-ethylhexyl) phthalate (hazard quotient = 10.3). TA-14 is not utilized by domestic animals or crops. Surface water associated with the site consists of infrequent runoff and was not evaluated as a source of drinking water. However, potential impacts to aquatic biota in surface water associated with the drainage in Cañon de Valle were assessed. For this evaluation, barium, beryllium, cadmium, and total lead were included as the constituents in surface runoff that may be hazardous to aquatic biota using the 95 percent upper confidence limit as the exposure concentration.

The following accounts describe the potential for exposure of each of the species as a result of thermal treatment operations at the TA-14 OB/OD units.

a. **Bald Eagle.** Bald eagles migrate and winter along the Rio Grande, roosting in White Rock Canyon and hunting on Cochiti Reservoir, as far upstream as Alamo Canyon. Storm water runoff from the area of the OB/OD units is hydrologically connected to this part of the Rio Grande through Cañon de Valle and Water Canyon, over a distance of about 9 miles, making possible a pathway for chemicals from this site to enter the food chain for this species. However, the large degree of dilution occurring along the path to the Rio Grande coupled with dilution within the reservoir itself would make this exposure pathway insignificant.

b. **Jemez Mountains Salamander.** The Jemez Mountains salamander has been recorded in several canyons that cross LANL boundaries. The species occurs in moist locations, such as rotting logs, and especially on north-facing slopes with slopes greater than 37 percent. It has been recorded at elevations ranging from over 10,000 feet down to 7,180 feet (in Los Alamos Canyon). In Cañon de Valle, the Jemez Mountains salamander has been found at an elevation of 8,101 feet. Thus, the OB/OD units are situated at the lower extreme of the known elevation range of this species and nearly 700 feet below its known occurrence in Cañon de Valle. Because the slopes below this site are south-facing, it is highly unlikely that the moist microhabitat conditions necessary for this species exist on these slopes. Therefore, due to the absence of favorable habitat conditions, it is unlikely that this species will be affected by thermal treatment operations at the OB/OD units.

c. **American Peregrine Falcon.** American peregrine falcon nesting habitat (cliffs) has been identified in Los Alamos County, north of LANL. The species has been observed on occasion in the area of LANL, but no nests have been recorded there. Lower Water and Ancho Canyons are marginally suitable for falcons, but no observations of the species have been made in the area of TA-14. Therefore, the potential for exposure of this species to chemical constituents resulting from thermal treatment operations at the OB/OD units is very low.

d. **Whooping Crane.** Whooping cranes migrate with sandhill cranes along the Rio Grande to and from their wintering areas in central New Mexico (e.g., the Bosque del Apache National Wildlife Refuge) and other locations farther south. They use open fields and shallow bodies of water for feeding and resting during migration. Migratory flights between these locations tend to be at high altitudes for extended distances. Because open habitats favorable to this species do not occur at LANL, it is not expected that this species will be present within LANL boundaries except possibly as a fly-over. Thus, the potential for exposure of this species as a result of thermal treatment operations at the TA-14 OB/OD units is very low.

e. **Broad-billed Hummingbird.** The broad-billed hummingbird nests in arid scrublands of southern New Mexico and occurs as far north as LANL as a vagrant. Thermal conditions limit the northern extent of successful breeding in this species. Therefore, its potential for occurrence at or near the OB/OD units is low, and the possibility of it nesting in the area is very remote. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is low.

f. **Southwestern Willow Flycatcher.** The southwestern willow flycatcher is known to occur in the Jemez Mountains, but breeding has not been confirmed there. Willow flycatchers nest in wooded riparian areas, particularly in willow-cottonwood associations. This species has been detected on LANL property. Although potential habitat exists for this species in Pajarito Canyon, it is unlikely to occur at or near the TA-14 OB/OD units due to the lack of favorable habitat in Cañon de Valle. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

g. **Gray Vireo.** The gray vireo nests in piñon-juniper woodlands throughout much of central New Mexico, occasionally being as far north as Santa Fe. It has not been recorded in the area of TA-14. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

h. **Meadow Jumping Mouse.** The meadow jumping mouse is typically found in dense, tall, grassy vegetation, especially near streams, meadows, and other wetlands. The species occurs at higher elevations and populations have been found along the Rio Grande in the central part of New Mexico. It has not been recorded in Los Alamos County and species-specific surveys at LANL have failed to document it in areas of favorable habitat. Because favorable habitat for this species does not occur at or near the OB/OD units at TA-14, it is highly unlikely that this species will be affected by thermal treatment operations at the site.

i. **Mexican Spotted Owl.** The Mexican spotted owl has been documented at LANL, and nesting and roosting habitat for this species has been identified along Cañon de Valle, adjacent to TA-14 (LANL, 1997b). Therefore, the potential exists for this species to occur at or near the OB/OD units. This species was used in the evaluation of ecological pathways.

As summarized above, all potential receptors within a 2 kilometer radius are evaluated in Appendix D of this document. For the human health evaluation, the only receptors within a 2 kilometer radius are LANL employees. Calculations of lifetime cancer risk are summarized in Table 3-4 of Appendix D of this document. Included in these calculations are risks to on-site personnel during routine operations using on-site analytical data, and risks to off-site personnel using available air modeling concentrations. All major exposure pathways are included in the risk calculations. For surface soil, these pathways include ingestion, dermal contact, and inhalation of fugitive dust. A complete description of the exposure models used in the risk calculations is also provided in Appendix D. Several ecological receptors occupying different trophic levels were used in the ecological risk assessment for TA-14 (see Appendix D). In each instance, the lower value of either the maximum detected concentration in soil or the 95 percent upper confidence limit of the mean concentration was used as the exposure concentration.

4.13 ARCHEOLOGICAL SITES

4.13.1 TA-14

A brief historical description of TA-14 and the OB/OD areas is provided in Section 2.1.1 of this document. There are 4 archeological sites within a 1,200-foot radius of the OB/OD units; the closest site is approximately 800 feet from the units (LANL, 1996e). There are no archeological sites within the hazard zone (a radius of approximately 700 feet) surrounding the OB/OD units.

4.14 NOISE, MINIMUM DISTANCE, AND GROUND VIBRATION CONSIDERATIONS

4.14.1 TA-14

Noise resulting from treatment activities is controlled by conducting treatment in a remote area within LANL boundaries. Impulse noise measurements were made at TA-14 during the detonation of explosives on two separate occasions in 1991. The TA-14 noise level data are provided in Appendix J of this document. The noise levels of three 20-pound detonations were recorded at four locations in relatively close proximity to the detonation area. (Note: 20 pounds of explosives waste is the maximum amount of waste that can be treated by OD at TA-14). The average noise level at the TA-14 site gate, located approximately 460 feet away, was 145 decibels (dB). Although noise level readings were not taken beyond the distance to the site gate, it is reasonable to assume that the noise level exposure to the nearest public receptor located over 6,000 feet away would be within acceptable limits. (For comparison purposes, six noise measurements made in White Rock [located more than four miles to the southeast] during detonations at the TA-15 PHERMEX site yielded a maximum peak noise level of 71.6 dBA for a 100-pound detonation. The TA-14 OD site is nearly six miles from White Rock and over two miles from the nearest approach to the Los Alamos townsite.) Workers involved in actual OD operations are stationed in the control room during detonation and, based on the levels measured, would receive exposure to approximately 122 dB, which is below the occupational exposure limit of 140 dB set by the American Conference of Governmental Industrial Hygienists.

LANL fully meets the minimum distance requirements of 20 NMAC 4.1.600 incorporating 40 CFR §265.382. The maximum amount of waste that can be treated at the OD unit at TA-14 is 20 pounds; this amount requires a minimum distance of 670 feet from the property of others. As can be seen on Map 2 of the OB/OD Part A, LANL maintains a safe distance greatly exceeding the minimum required distance.

LANL does not measure ground vibration during OD treatment operations. Due to the unit's remote location, the limited amount of waste treated per detonation, and the infrequency of treatment operations (up to 6 OD treatment operations per year), potential impacts to human health and the environment resulting from ground vibration are reasonably assumed to be minimal.

Table 4-1

Selected Parameters and Test Methods for Proposed Soil Monitoring Program at Technical Area 14

General Chemical Class	Parameter	EPA Hazardous Waste No.	Rationale for Parameter Selection	SW-846 Test Method[a]
Explosives	HMX[b]	D003	Determine the presence of explosive waste residues	8330
	RDX[c]	D003	Determine the presence of explosive waste residues	8330
	1,3,5-TNB[d]	D003	Determine the presence of explosive waste residues	8330
	1,3-DNB[e]	D003	Determine the presence of explosive waste residues	8330
	Tetryl[f]	D003	Determine the presence of explosive waste residues	8330
	NB[g]	D003	Determine the presence of explosive waste residues	8330
	2,4,6-TNT[h]	D003	Determine the presence of explosive waste residues	8330
	4-Am-DNT[i]	D003	Determine the presence of explosive waste residues	8330
	2-Am-DNT[j]	D003	Determine the presence of explosive waste residues	8330
	2,4-DNT[k]	D003	Determine the presence of explosive waste residues	8330
	2,6-DNT	D003	Determine the presence of explosive waste residues	8330
	2-NT[l]	D003	Determine the presence of explosive waste residues	8330
	3-NT	D003	Determine the presence of explosive waste residues	8330
	4-NT	D003	Determine the presence of explosive waste residues	8330
Metals	Barium	D005	Determine the presence of barium metal associated with the explosive-contaminated waste treated at the OB/OD units	7081

Table 4-1 (Continued)

Selected Parameters and Test Methods for Proposed Soil Monitoring Program at Technical Area 14

General Chemical Class	Parameter	EPA Hazardous Waste No.	Rationale for Parameter Selection	*SW-846* Test Method[a]
	Chromium[m]	D007	Determine the presence of chromium metal which may originate from detonator caps used in OD waste treatment process	7191
VOCs[n]	Methyl Ethyl Ketone	F005	Determine the presence of methyl ethyl ketone which may be present on explosive-contaminated rags and wipes treated at the OB unit	8260
	Toluene	F005	Determine the presence of toluene which may be present on explosive-contaminated rags and wipes treated at the OB unit	8260

a U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*.
b Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
c Hexahydro-1,3,5-trinitro-1,3,5-triazine
d TNB = trinitrobenzene
e DNB = dinitrobenzene
f Methyl-2,4,6-trinitrophenylnitramine
g NB = nitrobenzene
h TNT = trinitrotoluene
i 4-Amino-2,6-dinitrotoluene
j 2-Amino-4,6-dinitrotoluene
k DNT = dinitrotoluene
l NT = nitrotoluene
m Analyzed for in OD area samples only.
n VOCs=volatile organic compounds; analyzed for in OB area samples only.

Table 4-2

Average Background Concentrations for Selected Metals[a]

Element	Average Background Concentration (ppm)
Barium	108
Chromium	9.7

[a] Source: "Environmental Surveillance at Los Alamos During 1995," 1996, Los Alamos National Laboratory.

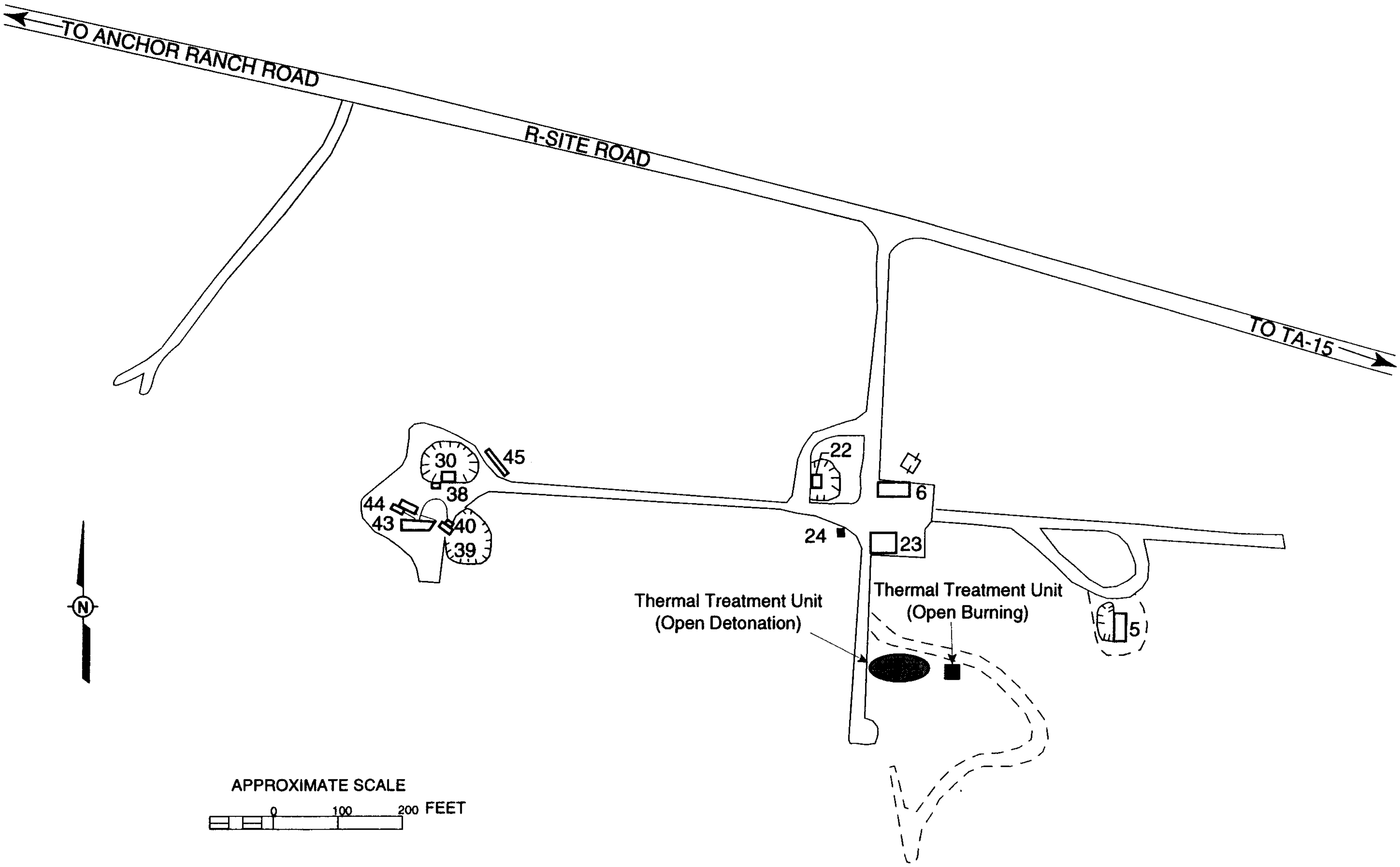

Figure 4-1
Location Map Showing the Thermal Treatment Units near Technical Area (TA) 14, Building 23

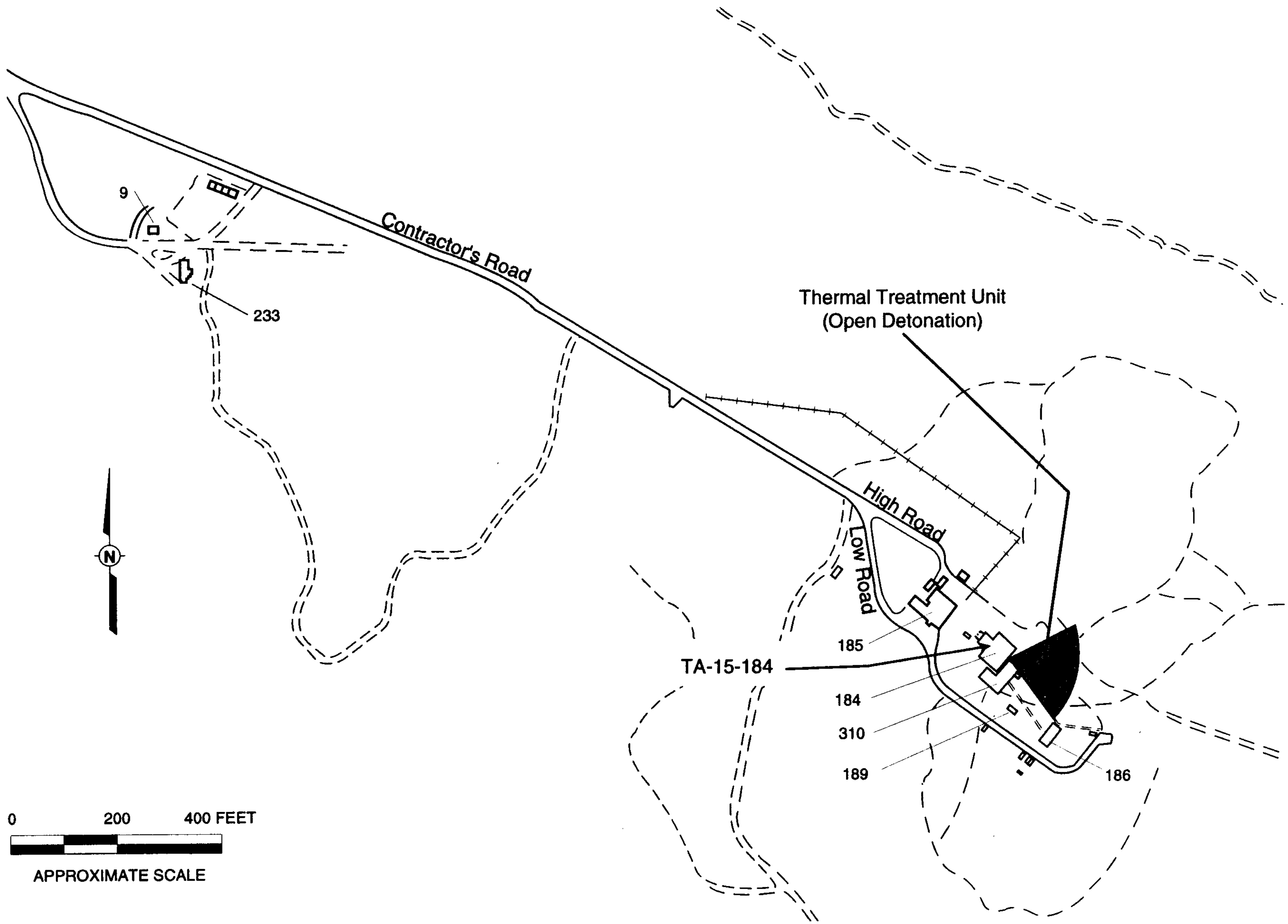

Figure 4-2
Location Map Showing the Thermal Treatment Unit near Technical Area (TA) 15, Building 184

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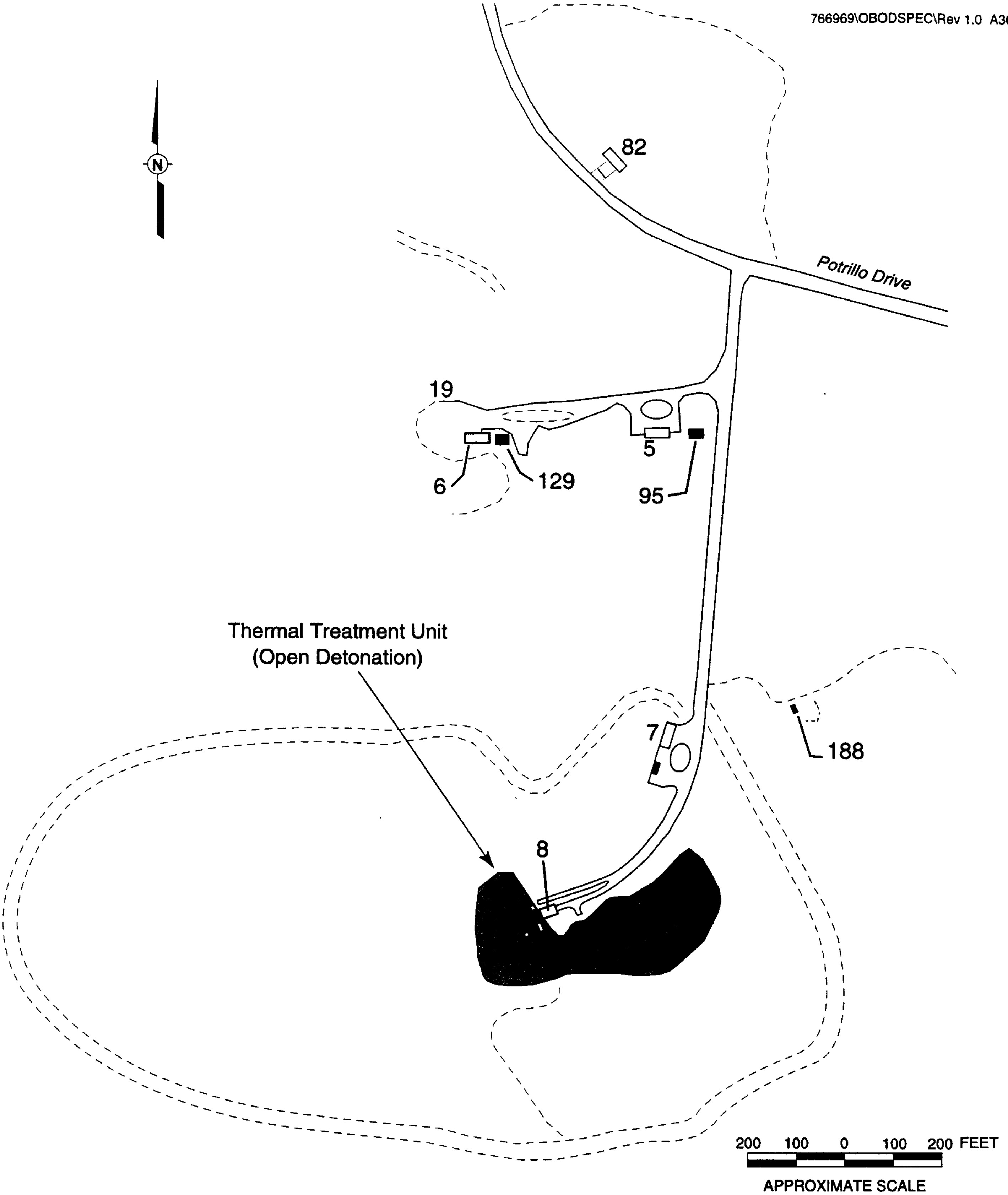

Figure 4-3
Location Map Showing the Thermal Treatment Unit near Technical Area 36, Building 8

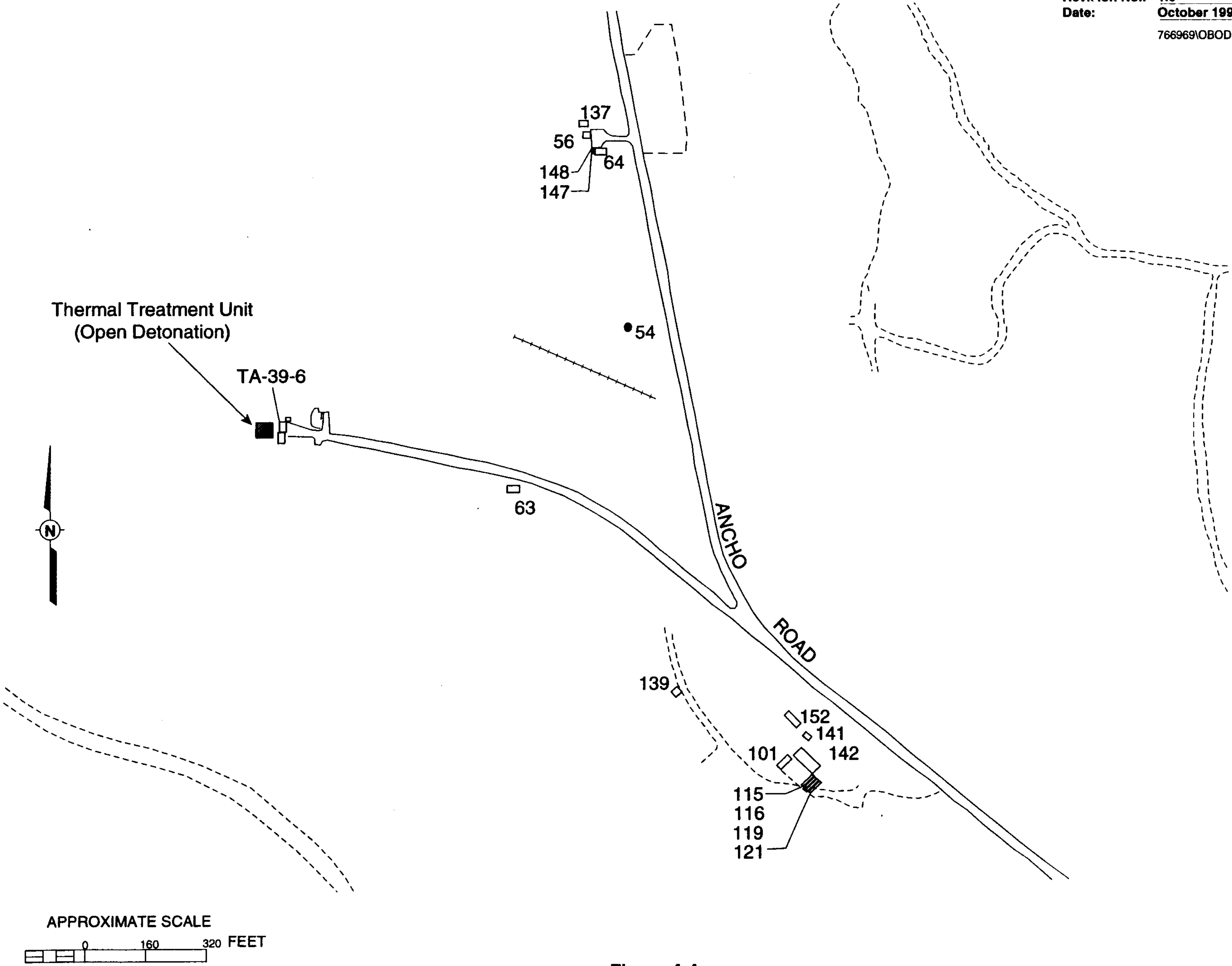

Figure 4-4
Location Map Showing the Thermal Treatment Unit near Technical Area (TA) 39, Building 6

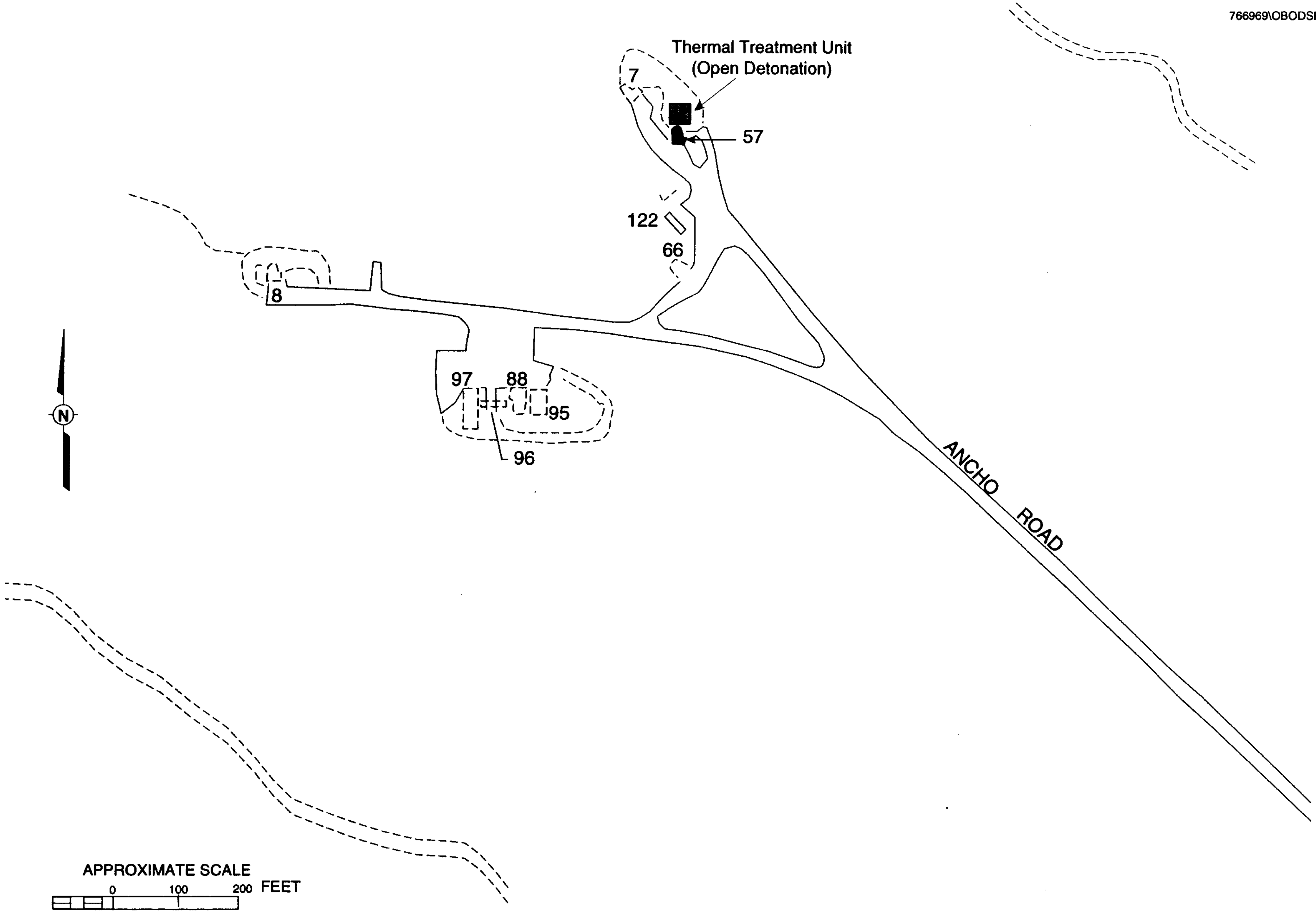

Figure 4-5
Location Map Showing the Thermal Treatment Unit near Technical Area 39, Building 57

ATTACHMENT 4-1

Potential Contaminant Migration Transport Pathways for Surface Water and Groundwater

Attachment 4-1

Attachment 4-1

1.0 INTRODUCTION

1.1 PURPOSE

This attachment addresses the requirements of the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), Part 264, Subpart X—Miscellaneous Units. The requirements of this subpart applies to owners and operators of facilities that treat, store, or dispose of hazardous waste in miscellaneous units. A model was constructed to simulate the migration of a contaminant that may result from contaminant spills followed by an unusually heavy rainstorm at the open burning/open detonation (OB/OD) thermal treatment units. This model specifically addresses the requirements of Subpart X that deal with potential contaminant migration transport pathways.

Table 1 is a cross-reference guide, listing the requirements of Subpart X and the section where each requirement is addressed, either in the main body of the Part B permit application, or in this attachment.

TABLE 1

Subpart X Cross Reference

Subpart X Requirement	Where Addressed
§ 264.601 Environmental performance standards. A miscellaneous unit must be located, designed, constructed, operated, maintained, and closed in a manner that will ensure protection of human health and the environment. Permits for miscellaneous units are to contain such terms and provisions as necessary to protect human health and the environment, including, but not limited to, as appropriate, design and monitoring requirements, and requirements for responses to releases of hazardous waste or hazardous constituents from the unit. Permit terms and provisions shall include those requirements of subparts I through O of this part, part 270, and part 146 that are appropriate for the miscellaneous unit being permitted. Protection of human health and the environment includes, but is not limited to:	
(a) Prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the ground water or subsurface environment, considering:	
(1) The volume and physical and chemical characteristics of the waste in the unit, including its potential for migration through soil, liners, or other containing structures;	Part B permit app., Section 4.0; Attachment 4-1, Section 4.0, 6.1
(2) The hydrologic and geologic characteristics of the unit and the surrounding area;	Part B permit app., Section 4.0; Attachment 4-1, Section 3.1, 3.2
(3) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground water;	Part B permit app., Section 4.0; Attachment 4-1, Section 3.3
(4) The quantity and direction of ground-water flow;	Attachment 4-1, Section 3.1
(5) The proximity to and withdrawal rates of current and potential ground water users;	Part B permit app., Section 2.0
(6) The patterns of land use in the region;	NA

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TABLE 1 (cont.)

Subpart X Cross Reference

Subpart X Requirement	Where Addressed
(7) The potential for deposition or migration of waste constituents into subsurface physical structures, and into the root zone of food-chain crops and other vegetation;	To be addressed during ER Project characterizations for OU 1132
(8) The potential for health risks caused by human exposure to waste constituents;	To be addressed during ER Project characterizations for OU 1132
(9) The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;	To be addressed during ER Project characterizations for OU 1132
(b) Prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in surface water, or wetlands or on the soil surface considering:	
(1) The volume and physical and chemical characteristics of the waste in the unit;	Part B permit app., Section 3.2
(2) The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing migration;	Part A
(3) The hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit;	Part A Part B permit app., Sections 2.0 and 4.0; Attachment 4-1, Section 3.1, 3.2
(4) The patterns of precipitation in the region;	Attachment 4-1, Section 3.3.1
(5) The quantity, quality, and direction of ground-water flow;	Attachment 4-1, Section 3.2
(6) The proximity of the unit to surface waters;	Part B permit app., Section 4.0; Attachment 4-1, Section 2.0, 3.2
(7) The current and potential uses of nearby surface waters and any water quality standards established for those surface waters;	Attachment 4-1, Section 3.4
(8) The existing quality of surface waters and surface soils, including other sources of contamination and their cumulative impact on surface waters and surface soils;	Attachment 4-1, Section 3.4
(9) The patterns of land use in the region; NA	NA
(10) The potential for health risks caused by human exposure to waste constituents;	To be addressed during ER Project characterizations for OU 1132
(11) The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.	To be addressed during ER Project characterizations for OU 1132
(c) Prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the air, considering:	[response to (c) and its subparagraphs (1) through (7) being prepared by Air Quality Group]

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TABLE 1 (cont.)

Subpart X Cross Reference

Subpart X Requirement	Where Addressed
(1) The volume and physical and chemical characteristics of the waste in the unit, including its potential for the emission and dispersal of gases, aerosols and particulates;	Part B permit app., Section 3.0
(2) The effectiveness and reliability of systems and structures to reduce or prevent emissions of hazardous constituents to the air;	
(3) The operating characteristics of the unit;	
(4) The atmospheric, meteorologic, and topographic characteristics of the unit and the surrounding area;	Attachment 4-1, Section 3.0
(5) The existing quality of the air, including other sources of contamination and their cumulative impact on the air;	
(6) The potential for health risks caused by human exposure to waste constituents;	
(7) The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.	
§ 264.602 Monitoring, analysis, inspection, response, reporting, and corrective action. Monitoring, testing, analytical data, inspections, response, and reporting procedures and frequencies must ensure compliance with §§264.601, 264.15, 264.33, 264.75, 264.76, 264.77, and 264.101 as well as meet any additional requirements needed to protect human health and the environment as specified in the permit.	Part B permit app., Section 4.0, 10.0
§ 264.603 Post-closure care. A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with §264.601 during the post-closure care period. In addition, if a treatment or storage unit has contaminated soils or ground water that cannot be completely removed or decontaminated during closure, then that unit must also meet the requirements of §264.601 during post-closure care. The post-closure plan under §264.118 must specify the procedures that will be used to satisfy this requirement.	NA

1.2 SCOPE

Subpart X of 20 NMAC 4.1, Subpart V, Part 264, requires permit applicants to show that they prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the ground water, surface water, soil, or subsurface environment.

This attachment evaluates possible waterborne waste transport pathways and their potential for contaminant migration by use of a simple model. The attachment lists the possible contaminants

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of concern and shows their origin and nature. It presents scenarios for possible waterborne migration, based on site geology, hydrology, and meteorology.

The model simulates the migration of a contaminant that may result from a contaminant spill followed by an unusually heavy rainstorm at two OD thermal treatment units. Contaminant concentrations were then estimated at the point where contaminants mix with runoff from the watershed associated with each OD thermal treatment unit, and where the runoff may reach receptors.

Maximum possible concentrations are estimated for contaminants of concern in the model and compared to Los Alamos National Laboratory (LANL) screening action levels (SAL).

2.0 SITE SELECTION RATIONALE

The OD thermal treatment units at Technical Area (TA) 39-6 and TA-39-57 were chosen for use in this demonstration because of their location. These sites are in the bottom of Ancho Canyon and are in close proximity to intermittent streams. A heavy rainstorm of sufficient volume could possibly transport potential contaminants to the Rio Grande approximately three miles away. It is expected that runoff at these OD thermal treatment units in the canyon bottom have a greater chance of reaching the Rio Grande than runoff from the sites on the mesa tops. For this model, contaminant concentrations were estimated at each OD thermal treatment unit, at State Road 4, and at the Rio Grande.

3.0 SITE CONDITIONS

3.1 GEOLOGY

LANL is located on the Pajarito Plateau on the eastern flank of the Jemez Mountains. This area is dominated by volcanic deposits associated with caldera formation and collapse; these deposits form broad plateaus surrounding the Jemez Mountains. The Pajarito Plateau consists of narrow mesas separated by deep canyons formed by southeast-trending intermittent streams. TA-39 is drained by a number of intermittent streams, tributaries of the main stream channel that runs through Ancho Canyon and joins the Rio Grande in White Rock Canyon. All of the canyons, through which these tributaries flow, contain alluvium unknown thickness. Other canyons on the plateau with a similar geology and topography (Mortandad, Canada del Buey, and Pajarito)

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contain alluvial deposits that vary greatly in thickness, from less than 3 feet (ft) thick to greater than 100 ft thick (Devaurs and Purtymun, 1985).

LANL is perched on a plateau consisting of mostly upper Tshirege and lower Otowi members of the Bandelier Tuff. At TA-39, the Bandelier Tuff ranges in thickness from several feet, along the northeastern margin of the site, to 600 feet, just west of TA-39 in Borehole DT9 (Purtymun, 1984).

3.2 HYDROLOGY

Ancho Canyon heads on the Pajarito Plateau on LANL property near the center of the southern LANL boundary and extends across the property to its confluence with the Rio Grande. The total drainage area of this canyon is approximately 7 square miles (LANL, 1993). The main channel length is approximately 6.9 miles (mi) long. The floor elevation of the canyon starts at just above 7,100 ft and drops to just below 5,400 ft at its confluence with the Rio Grande.

Ancho Canyon contains an ephemeral stream that is within LANL boundaries. It is at a approximately 0.8 mi upstream from the canyon's confluence with the Rio Grande. At this point, perennial flow to the Rio Grande is supported by a perennial spring, known as Ancho Spring. Ancho Canyon has no significant snowmelt runoff (LANL, 1996).

The surface of the main aquifer rises westward from the Rio Grande within the Santa Fe Group into the lower part of the Puye Conglomerate below the central and western part of the plateau. The main aquifer depths below the mesa top range from about 1,200 ft along the western margin of the plateau to about 600 ft at the eastern margin. The main aquifer is separated from the alluvium by 350 to 620 ft of tuff and volcanic sediments. The main aquifer is unconfined in the western part of the plateau and exhibits semiartesian to artesian conditions in the eastern part along the Rio Grande (Purtymun, 1994).

Available hydrologic data indicate that the major recharge area for the main aquifer is west of LANL, presumably in the Jemez Mountains, although this is still being investigated. Water in the main aquifer moves from its major recnarge area toward the Rio Grande, where part is discharged into the river through seeps and springs. The hydraulic gradient of the aquifer

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averages about 60 to 80 ft/mile within the Puye Conglomerate but increases to 80 to 100 ft/mile along the eastern edge of the plateau as the water in the aquifer enters the less permeable sediments of the Santa Fe Group. The rate of movement of water in the upper section of the aquifer varies, depending on the aquifer materials. Aquifer tests indicate the movement ranges from 20 ft/year in the Tesuque Formation to 345 ft/year in the more permeable Puye Conglomerate (Purtymun, 1984). No supply wells or test wells are located within the boundaries of TA-39 or within 3500 ft of the thermal treatment units.

Perched ground water zones, of limited extent, are known to occur below canyon alluvium and above the main aquifer in the Guaje Pumice bed at the base of the Bandelier Tuff and in the underlying conglomerates and basalts in parts of Pueblo Canyon, Los Alamos Canyon, and Sandia Canyon. Samples, from these zones, are routinely collected from two test wells and one spring which discharges from one of the zones (LANL, 1995).

Shallow alluvial ground water zones are known to exist in Pueblo Canyon, Los Alamos Canyon, Mortandad Canyon, and Pajarito Canyon. Shallow ground water may exist in parts of Water Canyon, Sandia Canyon, Potrillo Canyon, and Canon de Valle; however, several boreholes and observation wells have failed to confirm its presence. Alluvium in Ancho Canyon probably contains ground water due to recharge from storm runoff. While the extent of saturation in the alluvium is not known at present, it is probably small and occurs seasonally.

3.3 METEOROLOGY

3.3.1 Precipitation

Total annual precipitation, which includes rainfall and water-equivalent snowfall, averages approximately 19 inches (in.) at Los Alamos. Annual precipitation declines eastward, with the normal White Rock precipitation at 13.5 in., and increases westward to more than 25 in. in the Jemez Mountains. The higher precipitation toward the mountains is very noticeable during the summer when thundershowers develop over the mountains. Showers tend to form, or be stronger, over the mountains for much of the year. Winter storms associated with upslope winds drop more snow at higher elevations on the plateau.

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Los Alamos precipitation is characteristic of a semiarid climate. Variations in precipitation from year to year are quite large. Annual precipitation extremes range from 6.80 to 30.34 in. over a 71-year period. In 1986, 30.01 in. fell at the North Community site, near the Jemez Mountains.

3.3.2 Temperature

Despite Los Alamos' southern location, temperatures are cool at the 7,400-ft above mean sea level (amsl) elevation. Mean temperatures vary with altitude, averaging 5 degrees Fahrenheit (°F) higher in and near the Rio Grande Valley (6,500 ft amsl) and 5°F to 10°F lower in the nearby Jemez Mountains (8,500-10,000 ft amsl).

Winter temperatures typically range from 15°F to 25°F during the night and from 30°F to 50°F during the day. Cold arctic air masses occasionally invade the Los Alamos area from the N and NE, but often a shallow layer of coldest air is dammed to the east by the Sangre de Cristo Mountains. Occasionally, Los Alamos temperatures drop to 0°F or below.

Summers have moderately warm days and cool nights. Afternoon temperatures are in the 70s and 80s (°F) and occasionally reach 90°F. The relatively thin air, light winds, clear skies, and dry atmosphere cause nighttime temperatures to drop to the 50s (°F), even after the warmest day.

3.4 WATER, SOIL, AND AIR QUALITY

Surface water, ground water, soil, and sediments are routinely sampled at LANL as part of the environmental surveillance and environmental restoration activities. Data on the concentrations of various chemical constituents of interest in these media are published annually in the environmental surveillance reports (i.e., Environmental Surveillance at Los Alamos during 1992 (LANL, 1994), and at scheduled times in Environmental Restoration (ER) Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) reports.

4.0 POTENTIAL CONTAMINANTS

LANL's Environmental Protection Group (ESH-8) collected surface soil, sediment, and rinsate samples at the TA-39-6 and TA-39-57 OD units for the Corrective Activities Program.

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At each site, four transects radiating outward from the center of the detonation were sampled. Sampling plans (Fresquez, 1993) indicate that samples were screened for gross alpha, gross beta, and gross gamma. Samples were analyzed for:

- Toxicity characteristic leaching procedure (TCLP) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)
- Total beryllium, lead, and mercury
- Semivolatile organic compounds (SVOC)
- Volatile organic compounds (VOC)
- Polychlorinated biphenyls (PCB)
- Total uranium (U)
- High explosive (HE) residues (TNT, 2,4-DNT at both sites and HMX, RDX, TETRYL at TA-39-57)

Summary memos (Fresquez, 1994) discuss the analytical results.

At TA-39-57 no metals were detected above U.S. Environmental Protection Agency (EPA) action levels. Five SVOCs were detected in samples; only 2,4-dinitrotoluene was detected above EPA action levels. Four VOCs were detected at parts per billion levels and were below EPA action levels. No PCBs were detected. The average concentration of total U over this site was 134.2 (+ or - 243.8) milligram per gram (mg/g) compared to an upper limit for total U in background samples in the Los Alamos area of 3.4 mg/g. Some HE residues of HMX and RDX were detected within 80 ft of the detonation area.

At TA-39-6 four soil samples exceeded TCLP-Pb proposed EPA action levels. All other metals analyzed were below EPA action levels. Four different SVOCs were detected below EPA action levels. Five VOCs were detected at parts per billion levels and were below EPA action levels. One soil sample contained traces of PCBs at 1.1 mg/g. No HE residues were detected. Total U in samples ranged in concentration from 0.833 to 72.3 mg/g, with the average concentration over the site being 15.35 (+ or - 21) mg/g.

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The results of these sampling events give a limited picture of potential contaminants at the sites. Additional sampling is proposed at these sites to meet ER requirements for potential release site characterization. It is proposed that samples be analyzed for a more complete analytical suite, collected at depth as well as surface levels, and collected at biased locations.

5.0 ACTION LEVELS

The ER Program at LANL takes its primary direction from EPA guidance (EPA, 1989). Subsequent guidance, Corrective Action for Solid Waste Management Units (Subpart S) (EPA, 1990), a proposed regulation under RCRA, presents a methodology for calculating action levels to determine the need for further evaluation of contamination in various environmental media (i.e., ground water, surface water, air, and soil). The action levels are calculated using chemical-specific toxicity values and default exposure parameters. In order to comply with the Hazardous and Solid Waste Amendments Module for the Laboratory, SALs have been developed that follow the Subpart S methodology for exposure parameter defaults but incorporate more recent toxicity values available from the EPA's Integrated Risk Information System data base (EPA, 1993) and Health Effects Assessment Summary Tables, (EPA, 1992), which are updated periodically.

In deriving SALs for constituents in water, it is assumed that a 70-kilogram (kg) adult ingests water at a rate of 2 liters/day over a 70-year exposure duration. These SALs apply to constituents in both ground water and surface water.

SAL derivations are based on assumptions and equations contained in proposed Subpart S. A complete discussion of assumptions and equations is given in the Installation Work Plan Appendix J (LANL, 1993).

6.0 HYPOTHETICAL SCENARIO

The model simulates contaminant migration resulting from a contaminant spill followed by an unusually heavy rainstorm at two OD thermal treatment units. Contaminant concentrations were estimated at the point where contaminants mix with runoff from the watershed associated with each thermal treatment unit, and where the runoff may reach receptors.

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6.1 CONTAMINANTS OF CONCERN FOR SCENARIO

Contaminants of concern for the thermal treatment units are those that may potentially migrate from the site in quantities above established SALs. Barium dinitrate and 2,4-dinitrotoluene (2,4-DNT) were chosen for this scenario. Barium dinitrate is a major compound present in HE before it is flashed; and 2,4-DNT was one of the SVOCs detected above EPA action levels in the Environmental Protection Group's sampling activities discussed in Section 4.0.

In the scenario it is assumed that barium dinitrate ($Ba[NO3]_2$) and 2,4-DNT are spilled onto the soil surface in amounts and forms that are typical for residues after a detonation. Rainfall in a 2-year 6-hour storm then falls on the spill, completely dissolving the $Ba(NO3)_2$ and dissolving the 2,4-DNT to saturation. The water is then assumed to runoff the spill area without attenuation of the contaminant concentrations and mix at two points downstream with runoff from the storm over a 24-hour period.

6.2 PRECIPITATION EVENT FOR SCENARIO

A 2-year 6-hour precipitation event will drop 0.82 in. of rain at TA-39-6 and 0.98 in. of rain at TA-39-57 (McLin, 1996; Floodplain Elevations and Flows in Ancho Canyon). Table 2 lists the discharges and the discharge volumes over a 24-hour period, at locations downstream entering the main drainage, resulting from the hypothetical 2-year 6-hour precipitation event .

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TABLE 2

Peak Discharges and Discharge Volumes From a 2-year 6-hour Precipitation Event

Cross Section	Peak Discharge (cubic feet per second)	24-Hour Discharge Volume (acre-feet)	24-Hour Discharge Volume (L)
FS-6	1	0.20	246,723
FS-57	3	0.50	616,809
State Road 4	3	0.99	1;221,283
Rio Grande	1	0.50	616,809

6.3 CONCENTRATION CALCULATIONS FOR SCENARIO

For the calculation it is assumed that barium and 2-4-DNT spills at TA-39-6 and at TA-39-57. Each consists of 1/2 kg of barium (as soluble $Ba(NO3)_2$) plus pieces of 2,4-DNT with a total surface area each of 0.06 square feet. The mass of 2,4-DNT is sufficient to saturate the rain falling on the surface area of the 2,4-DNT pieces over the entire storm event. The solubility of 2,4-DNT is 240 milligrams per liter. The solution is then diluted as the runoff moves away from the site and is combined with runoff from larger watersheds. Concentrations calculated at the site, at State Road 4, and at the Rio Grande are shown in Table 3.

TABLE 3

Concentrations Calculated at Open Detonation Thermal Units Technical Area (TA)-39-6 and TA-39-57

Contaminant	TA-39-6 Discharge Point	TA-39- Concentration at Discharge Point	TA-39-57 Discharge Point	TA-39-57 Concentration at Discharge Point	SAL
Barium	FS-6	2.0 mg/l	FS-57	0.8 mg/l	2 mg/l
	State Road 4	0.34 mg/l	State Road 4	0.27 mg/l	
	Rio Grande	0.24 mg/l	Rio Grande	0.20 mg/l	
2,4-dinitrotoluene	FS-6	0.113 μg/l	FS-57	5.4×10^{-2} μg/l	73 μg/l
	State Road 4	0.019 μg/l	State Road 4	1.8×10^{-2} μg/l	
	Rio Grande	0.013 μg/l	Rio Grande	1.4×10^{-2} μg/l	

Footnotes: SAL = screening action levels; mg = milligrams; μg = micrograms; l = liter

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7.0 GROUND WATER TRANSPORT

The potential for precipitation to carry contaminants from the canyon bottoms downward to ground water aquifers is low due to the thickness and extreme dryness of the underlying soils and rock. Depth of penetration of the infiltrating waters will depend on the amounts and duration of rainfall and whether the waters intercept a fracture or fault.

Water will be present in the canyon bottom more frequently than during the 2-year 6-hour hypothetical precipitation event. This will dilute the waters that may contribute to ground water, resulting in significantly lower concentrations. Barium will likely precipitate out of the infiltrating waters primarily as sulfate and build up in the upper soil horizon. 2,4-DNT will chemically precipitate in the soil horizon and will be degraded in a matter of months. While the canyon bottom is the most likely pathway to ground water aquifers, the concentration of contaminants in these waters will be very low.

Additional sampling will further define constituents of concern and indicate areas where further analysis may be necessary.

8.0 CONCLUSIONS

The calculated concentrations are the results of an unlikely scenario where significant quantities of toxic materials remain on the ground after detonation. The concentrations calculated are higher than any values anticipated as a result of inadvertent releases from thermal unit operations. Under this scenario the concentration of only barium among the contaminants of concern are close to the SALs at one of the points calculated. These calculations ignore topography, degradation, and sorption to soils or sediments, as well as physical mass transport of HE solid particles. It was also assumed that momentary contact with rainwater is sufficient to cause full dissolution or chemical saturation. While these calculations are conservative, they do emphasize the importance of carefully evaluating the results of the planned sampling events.

While the concentrations are, in some cases, close to SALs, it should be noted that the SALs represent concentrations assuming that a 70-kg adult ingests water at a rate of 2 liters per day for 70 years. The numbers given were developed for a single precipitation event lasting 6 hours and occurring, on average, once every two years.

This simple analysis provides a conceptual model for evaluating the potential contribution to surface and ground waters for contaminants that may be present at the sites. More comprehensive modeling including the kinetics of dissolution, degradation, sorption to soils, particle transport, bioaccumulation, and ground water contributions is necessary to define a more accurate picture.

9.0 REFERENCES

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ATTACHMENT 4-2

Measures Implemented to Comply with the National Pollutant Discharge Elimination System General Permit

Measures Implemented to Comply with the National Pollutant Discharge Elimination System General Permit

Identify members of a Pollution Prevention Team to develop the Storm Water Pollution Prevention (SWPP) Plan and assist in the implementation, maintenance, and revision of the plan.

Provide a description of the potential pollutant sources exposed to storm water, including pollutant sources not associated with waste treatment.

Prepare a drainage map indicating an outline of the drainage area of each storm water outfall. The map includes structural control measures, if any, to reduce pollutant migration; surface water bodies; material storage areas; and other pollutant sources.

Maintain a current inventory of materials exposed to storm water, including a narrative description of materials handled, treated, stored, and disposed of since 1989.

Maintain a description of spills or leaks since 1989 and the actions taken to prevent a reoccurrence.

Maintain a summary of any surface water sampling data from the site.

Prepare a narrative description of the potential pollutant sources associated with loading and unloading operations, outdoor storage, outdoor manufacturing or processing, dust and particulate generating activities, and on-site waste disposal activities.

Prepare a description of the measures and controls implemented to control and reduce the amount of pollutants in the storm water discharges. These measures and controls include:

- Good housekeeping
- Preventive maintenance program for storm water management devices

- Spill prevention and response procedures
- Inspections
- Employee training
- Recordkeeping and internal reporting procedures
- A listing of non-storm-water discharges, sediment and erosion control, and the management of runoff.

Prepare a self conducted comprehensive site compliance evaluation to determine compliance with the site-specific SWPP Plan.

ATTACHMENT 4-3

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 14, Building 35

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 14, Building 35

In March 1993, 21 soil samples were collected at the 0- to 3-inch depth along four transects radiating outward from the center of the detonation area. In addition, two sediment samples were collected from two downgradient drainage channels from the detonation area. A sample was also collected from the rinsate of the scattered surface debris around the detonation area. The soil and sediment samples were screened for gross alpha, beta and gamma radioactivity. The soil, sediment, and rinsate samples were then analyzed for: toxicity characteristic leaching procedure (TCLP) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver); total beryllium, total lead, total uranium, and strontium-90; semivolatile organic compounds (SVOC); and high explosive residues. The results of the analyses are listed below.

- Two soil samples had TCLP lead concentrations exceeding the U.S. Environmental Protection Agency (EPA) regulatory level of 5 parts per million (ppm). No other TCLP metals were detected in the soil, sediment, or rinsate samples above EPA regulatory levels.
- Total beryllium concentrations in the soil samples did not exceed the upper limit background concentrations for the Los Alamos area of 2.88 ppm.
- Total lead concentrations ranged from less than 15 micrograms per gram (μg/g) to 410 μg/g.
- Total uranium in the soil samples ranged from 1.8 to 31.16 μg/g with an average concentration of 5.75 μg/g. Total uranium in the sediment samples averaged 2.59 μg/g. The upper limit background concentration for total uranium in the Los Alamos is 3.4 μg/g. Total uranium was detected in the rinsate sample at 12 μg/l.
- Strontium-90 concentrations ranged from 0 to 1.1 picocuries per gram.
- One SVOC was detected at three soil sample locations and one sediment sample location. An additional SVOC was detected at one of the soil sample locations, and another SVOC was detected at a separate soil sample location. These SVOCs were detected at concentrations far below EPA proposed action levels.
- High explosive residues, including HMX, RDX, TETRYL, and TNT, were detected in all of the soil and sediment samples collected and ranged in concentration from 0.7 μg/g to 876 μg/g.

ATTACHMENT 4-4

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 15, Building 184

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 15, Building 184

In April 1993, soil samples were collected at the 0- to 3-inch depth along four transects radiating outward from the center of the detonation area. Two sediment samples were taken from drainage channels located near and downgradient from the detonation area. A sample was also collected from rinsate of the scattered surface debris from around the detonation area.

Soil and sediment samples were screened for: gross alpha, beta, and gamma radioactivity. The soil, sediment, and rinsate samples were analyzed for toxicity characteristic leaching procedure (TCLP) metals; total beryllium (Be), total gallium (Ga), total mercury (Hg), total lead (Pb), and total thorium (Th); semivolatile organic compounds (SVOC); and high explosive residues. The results are summarized below.

- Two soil samples contained Pb above the U.S. Environmental Protection Agency proposed action level of 5 parts per million (ppm). No other TCLP metals were detected in any sample.
- Some surface soil samples contained Be above the upper limit background concentrations for the Los Alamos area of 2.88 ppm.
- Twenty-one SVOCs were found in soil samples, but most are considered complex compounds derived from plastics.
- Explosives residues were not detected in any of the samples.

ATTACHMENT 4-5

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 36, Building 8

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 36, Building 8

In March 1994, 24 soil samples were collected at each detonation area at the 0- to 3-inch depth along four directions at various distances away from the center of each pad. A sediment sample was collected from drainage channels located near and downgradient from the detonation areas. A sample was collected from rinsate of the scattered surface debris from around the detonation area. The soil and sediment samples were screened for: gross alpha, beta, and gamma radioactivity. The soil, sediment and rinsate samples were analyzed for toxicity characteristic leaching procedure (TCLP) metals; aluminum, beryllium, copper, and iron; semivolatile organic compounds (SVOC); total uranium and high explosive residues. The results are listed below.

- One soil sample contained Pb above the U.S. Environmental Protection Agency proposed action level of 5 parts per million. No other TCLP metals were detected above regulatory levels in the soil, sediment, or rinsate samples.
- Five SVOCs were detected at seven soil sample locations and at the sediment sample location, but these SVOCs are considered complex compounds derived from plastics.
- High explosives residues were detected in many of the soil samples and in the sediment samples. No high explosives were detected in the rinsate sample.

ATTACHMENT 4-6

Correction of Data for the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 36, Building 8

REPORT NUMBER: 20618

*********** EM-9 ANALYTICAL REPORT ************

Prepared by: D GERTH on 20-Sep-1993

REQUEST NUMBER: 13501 MATRIX: SE ANALYST: MET PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 132

CUSTOMER SAMPLES:

TCLP

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
PF-368-W-20	92.27444	AG	ICPES	< 0.01		MG/L	6/16/93	05261H
PF-368-W-20	92.27444	BA	ICPES	1.6	0.2	MG/L	6/16/93	05261H
PF-368-W-20	92.27444	CD	ICPES	0.034	0.003	MG/L	6/16/93	05261H
PF-368-W-20	92.27444	CR	ICPES	< 0.004		MG/L	6/16/93	05261H
PF-368-W-20	92.27444	PB	ICPMS	0.05	0.02	MG/L	6/16/93	05261H
PF-368-W-40	92.27445	AG	ICPES	< 0.01		MG/L	6/16/93	05261H
PF-368-W-40	92.27445	BA	ICPES	3.	0.3	MG/L	6/16/93	05261H
PF-368-W-40	92.27445	CD	ICPES	0.073	0.007	MG/L	6/16/93	05261H
PF-368-W-40	92.27445	CR	ICPES	< 0.004		MG/L	6/16/93	05261H
PF-368-W-40	92.27445	PB	ICPMS	0.1	0.03	MG/L	6/16/93	05261H
PF-368-W-60	92.27446	AG	ICPES	< 0.01		MG/L	6/16/93	05261H
PF-368-W-60	92.27446	BA	ICPES	1.8	0.2	MG/L	6/16/93	05261H
PF-368-W-60	92.27446	CD	ICPES	0.004	0.002	MG/L	6/16/93	05261H
PF-368-W-60	92.27446	CR	ICPES	< 0.004		MG/L	6/16/93	05261H
PF-368-W-60	92.27446	PB	ICPMS	< 0.03		MG/L	6/16/93	05261H
PF-368-W-100	92.27447	AG	ICPES	< 0.01		MG/L	6/16/93	05261H
PF-368-W-100	92.27447	BA	ICPES	4.	0.4	MG/L	6/16/93	05261H
PF-368-W-100	92.27447	CD	ICPES	0.13	0.01	MG/L	6/16/93	05261H
PF-368-W-100	92.27447	CR	ICPES	< 0.004		MG/L	6/16/93	05261H
PF-368-W-100	92.27447	PB	ICPMS	0.11	0.01	MG/L	6/16/93	05261H
PF-368-W-150	92.27448	AG	ICPES	< 0.01		MG/L	6/16/93	05261H
PF-368-W-150	92.27448	BA	ICPES	2.5	0.3	MG/L	6/16/93	05261H
PF-368-W-150	92.27448	CD	ICPES	< 0.003		MG/L	6/16/93	05261H
PF-368-W-150	92.27448	CR	ICPES	0.005	0.002	MG/L	6/16/93	05261H
PF-368-W-150	92.27448	PB	ICPMS	< 0.03		MG/L	6/16/93	05261H
PF-368-E-20	92.27449	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-E-20	92.27449	BA	ICPES	1.5	0.2	MG/L	6/17/93	05261H
PF-368-E-20	92.27449	CD	ICPES	0.028	0.003	MG/L	6/17/93	05261H
PF-368-E-20	92.27449	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-368-E-20	92.27449	PB	ICPMS	0.07	0.02	MG/L	6/17/93	05261H
PF-368-E-40	92.27450	AG	ICPES	0.013	0.001	MG/L	6/17/93	05261H
PF-368-E-40	92.27450	BA	ICPES	0.22	0.02	MG/L	6/17/93	05261H
PF-368-E-40	92.27450	CD	ICPES	< 0.003		MG/L	6/17/93	05261H
PF-368-E-40	92.27450	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-368-E-40	92.27450	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-E-60	92.27451	AG	ICPES	0.018	0.002	MG/L	6/17/93	05261H
PF-368-E-60	92.27451	BA	ICPES	3.4	0.3	MG/L	6/17/93	05261H

PF-368-E-60	92.27451	CD	ICPES	0.057	0.006	MG/L	6/17/93	05261H
PF-368-E-60	92.27451	CR	ICPES	0.007	0.003	MG/L	6/17/93	05261H
PF-368-E-60	92.27451	PB	ICPMS	0.28	0.03	MG/L	6/17/93	05261H
PF-368-E-100	92.27452	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-E-100	92.27452	BA	ICPES	4.1	0.4	MG/L	6/17/93	05261H
PF-368-E-100	92.27452	CD	ICPES	0.032	0.003	MG/L	6/17/93	05261H
PF-368-E-100	92.27452	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-368-E-100	92.27452	PB	ICPMS	0.26	0.03	MG/L	6/17/93	05261H
PF-368-E-150	92.27453	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-E-150	92.27453	BA	ICPES	0.94	0.09	MG/L	6/17/93	05261H
PF-368-E-150	92.27453	CD	ICPES	< 0.003		MG/L	6/17/93	05261H
PF-368-E-150	92.27453	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-368-E-150	92.27453	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-N-20	92.27454	AG	ICPES	0.012	0.003	MG/L	6/17/93	05261H
PF-368-N-20	92.27454	BA	ICPES	2.2	0.2	MG/L	6/17/93	05261H
PF-368-N-20	92.27454	CD	ICPES	0.041	0.004	MG/L	6/17/93	05261H
PF-368-N-20	92.27454	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-368-N-20	92.27454	PB	ICPMS	0.49	0.05	MG/L	6/17/93	05261H
PF-368-N-40	92.27455	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-N-40	92.27455	BA	ICPES	7.	0.7	MG/L	6/17/93	05261H
PF-368-N-40	92.27455	CD	ICPES	0.032	0.003	MG/L	6/17/93	05261H
PF-368-N-40	92.27455	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-368-N-40	92.27455	PB	ICPMS	0.03	0.02	MG/L	6/17/93	05261H
PF-368-N-60	92.27456	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-N-60	92.27456	BA	ICPES	1.8	0.2	MG/L	6/17/93	05261H
PF-368-N-60	92.27456	CD	ICPES	0.007	0.003	MG/L	6/17/93	05261H
PF-368-N-60	92.27456	CR	ICPES	0.006	0.003	MG/L	6/17/93	05261H
PF-368-N-60	92.27456	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-N-100	92.27457	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-N-100	92.27457	BA	ICPES	6.5	0.7	MG/L	6/17/93	05261H
PF-368-N-100	92.27457	CD	ICPES	0.34	0.03	MG/L	6/17/93	05261H
PF-368-N-100	92.27457	CR	ICPES	0.011	0.004	MG/L	6/17/93	05261H
PF-368-N-100	92.27457	PB	ICPMS	0.03		MG/L	6/17/93	05261H
PF-368-N-150	92.27458	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-N-150	92.27458	BA	ICPES	3.6	0.4	MG/L	6/17/93	05261H
PF-368-N-150	92.27458	CD	ICPES	0.034	0.003	MG/L	6/17/93	05261H
PF-368-N-150	92.27458	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-368-N-150	92.27458	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-S-20	92.27459	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-S-20	92.27459	BA	ICPES	0.58	0.06	MG/L	6/17/93	05261H
PF-368-S-20	92.27459	CD	ICPES	< 0.003		MG/L	6/17/93	05261H
PF-368-S-20	92.27459	CR	ICPES	0.012	0.001	MG/L	6/17/93	05261H
PF-368-S-20	92.27459	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-S-40	92.27460	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-S-40	92.27460	BA	ICPES	2.9	0.3	MG/L	6/17/93	05261H
PF-368-S-40	92.27460	CD	ICPES	0.019	0.002	MG/L	6/17/93	05261H
PF-368-S-40	92.27460	CR	ICPES	0.011	0.001	MG/L	6/17/93	05261H
PF-368-S-40	92.27460	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-S-60	92.27461	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-S-60	92.27461	BA	ICPES	3.1	0.3	MG/L	6/17/93	05261H
PF-368-S-60	92.27461	CD	ICPES	0.023	0.005	MG/L	6/17/93	05261H
PF-368-S-60	92.27461	CR	ICPES	0.008	0.001	MG/L	6/17/93	05261H
PF-368-S-60	92.27461	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-S-100	92.27462	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-S-100	92.27462	BA	ICPES	2.3	0.2	MG/L	6/17/93	05261H
PF-368-S-100	92.27462	CD	ICPES	0.004	0.002	MG/L	6/17/93	05261H
PF-368-S-100	92.27462	CR	ICPES	0.013	0.001	MG/L	6/17/93	05261H
PF-368-S-100	92.27462	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-368-S-150	92.27463	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-368-S-150	92.27463	BA	ICPES	1.6	0.2	MG/L	6/17/93	05261H

PF-36B-S-150	92.2[illegible]46	CD	ICPES	< 0.003		MG/L	6/17/93	05261H
PF-36B-S-150	92.2[illegible]46[illegible]	CR	ICPES	0.016	0.005	MG/L	6/17/93	05261H
PF-36B-S-150	92.27463	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-36B-SED	92.27464	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-36B-SED	92.27464	BA	ICPES	3.4	0.3	MG/L	6/17/93	05261H
PF-36B-SED	92.27464	CD	ICPES	0.004	0.002	MG/L	6/17/93	05261H
PF-36B-SED	92.27464	CR	ICPES	0.006	0.002	MG/L	6/17/93	05261H
PF-36B-SED	92.27464	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-36B-O-O	92.27465	AG	ICPES	< 0.01		MG/L	6/17/93	05261H
PF-36B-O-O	92.27465	BA	ICPES	1.2	0.1	MG/L	6/17/93	05261H
PF-36B-O-O	92.27465	CD	ICPES	0.018	0.002	MG/L	6/17/93	05261H
PF-36B-O-O	92.27465	CR	ICPES	< 0.004		MG/L	6/17/93	05261H
PF-36B-O-O	92.27465	PB	ICPMS	< 0.03		MG/L	6/17/93	05261H
PF-36B-E60R	92.27466	AG	ICPES	0.019	0.002	MG/L	6/17/93	05261H
PF-36B-E60R	92.27466	BA	ICPES	3.2	0.3	MG/L	6/17/93	05261H
PF-36B-E60R	92.27466	CD	ICPES	0.054	0.005	MG/L	6/[illegible]7/93	05261H
PF-36B-E60R	92.27466	CR	ICPES	< 0.004		MG/L	6/[illegible]7/93	05261H
PF-36B-E60R	92.27466	PB	ICPMS	1.1	0.1	MG/L	6/17/93	05261H
PF-36A-RIN	92.27468	AG	ICPES	< 0.01		MG/L	9/20/93	
PF-36A-RIN	92.27468	BA	ICPES	< 0.07		MG/L	9/20/93	
PF-36A-RIN	92.27468	CD	ICPES	< 0.01		MG/L	9/20/93	
PF-36A-RIN	92.27468	CR	ICPES	< 0.01		MG/L	9/20/93	
PF-36A-RIN	92.27468	PB	ICPES	< 0.05		MG/L	9/20/93	
PF-36B-RIN	92.27469	AG	ICPES	< 0.01		MG/L	9/20/93	
PF-36B-RIN	92.27469	BA	ICPES	0.96	0.1	MG/L	9/20/93	
PF-36B-RIN	92.27469	CD	ICPES	0.01	0.01	MG/L	9/20/93	
PF-36B-RIN	92.27469	CR	ICPES	< 0.01		MG/L	9/20/93	
PF-36B-RIN	92.27469	PB	ICPES	0.05	0.05	MG/L	9/20/93	

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REPORT NUMBER: 20618 (continued)

EM-9 QUALITY ASSURANCE REPORT

Prepared by: D GERTH on 20-Sep-1993

REQUEST NUMBER: 13501 MATRIX: SE ANALYST: MET PROGRAM CODE: W106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 132

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.27503	AG	2.2	0.2	MG/L	2.	0.08	6/18/93	UNDER CONTROL
00.27503	BA	9.8	1.	MG/L	10.	0.4	6/18/93	UNDER CONTROL
00.27503	CD	10.	1.	MG/L	10.	0.4	6/18/93	UNDER CONTROL
00.27503	CR	9.5	1.	MG/L	10.	0.4	6/18/93	UNDER CONTROL
00.27503	PB	10.	1.	MG/L	10.	0.4	6/18/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

_✓_ Only Open (non-blind) QC samples run with this sample batch.

___ No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within EM-9

REPORT NUMBER: 20618

G D Morgan	D Gerth	[illegible]	mag
Analyst	Reviewer	Section Leader	QA Officer
9/22/93	9/22/93	9/22/93	9/22/93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

ATTACHMENT 4-7

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 39, Building 6

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 39, Building 6

In March 1993, 20 soil samples were collected at the 0- to 3-inch depth along four transects radiating outward from the center of the detonation area. Two sediment samples were collected from drainage channels downgradient to the detonation area. A sample was collected from rinsate of scattered surface debris at the detonation area. The soil and sediment samples were screened for gross alpha, beta, and gamma radioactivity. The soil, sediment and rinsate samples were analyzed for toxicity characteristic leaching procedure (TCLP) metals; total lead (Pb), total mercury, and total beryllium; semivolatile organic compounds (SVOC); volatile organic compounds (VOC); and high explosives residues. The results are summarized below.

- Four soil samples contained Pb above 5 parts per million. No other TCLP metals or total metals were detected above action levels in the soil sediment or rinsate samples.
- Total beryllium and total mercury in the soil samples were below U.S. Environmental Protection Agency (EPA) action levels.
- Eight soil samples contained from one to four SVOCs; however, all the SVOCs were far below EPA action levels.
- Five VOCs were detected in soil samples, but were far below EPA action levels.
- No high explosives residues were detected in any of the samples.

ATTACHMENT 4-8

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 39, Building 57

Results Summary of the Soil Sampling Survey Conducted Over Active Firing Site at Technical Area 39, Building 57

In March 1993, 21 soil samples were collected at the 0- to 3-inch depth along four transects radiating outward from the center of the detonation area. Two sediment samples were collected from drainage channels downgradient to the detonation area. A sample was collected from the rinsate of scattered debris at the area. The soil and sediment samples were screened for gross alpha, beta, and gamma radioactivity. The soil, sediment, and rinsate samples were analyzed for toxicity characteristic leaching procedure (TCLP) metals; total lead, mercury, and beryllium; semivolatile organic compounds (SVOC); volatile organic compounds (VOC); polychlorinated biphenyls (PCB); and high explosives residues. The results are summarized below.

- No TCLP metals or total metals were detected above action levels in any sample.
- Of five SVOCs detected in soil samples, only one (2,4-dinitrotoluene) was present above the U.S. Environmental Protection Agency (EPA) action levels in three soil samples.
- Four VOCs were detected in soil samples, but were far below EPA action levels.
- No PCBs were detected in any sample.

ATTACHMENT 4-9

Air Quality Impact Modeling

Air Quality Impact Modeling

Air emissions from the open detonation of wood and plastic waste at Technical Area (TA) 14, TA-15, TA-36, and TA-39 are regulated under National and New Mexico Ambient Air Quality Standards. Air emissions from these operations could include criteria pollutants such as carbon monoxide, oxides of nitrogen, particulate matter, sulfur dioxide, and volatile organic compounds. In addition, some hazardous air pollutants such as hydrogen chloride and hydrogen fluoride are emitted as a result of combustion of the binders used to form the high explosives used in the waste treatment. Impacts from operations of this type must meet ambient air standards for all criteria pollutants[1]. In addition the waste had the potential for being contaminated with other regulated hazardous materials such as lead and depleted uranium (dU).

Source terms or the amount of pollutants generated during treatment activities (i.e., detonation) were estimated using published emission factors (AP-42; developed by the U.S. Environmental Protection Agency [EPA]), mass balance calculations, process knowledge, and engineering estimates. In addition, estimates were based on waste profiles containing 90% wood/cardboard/ burlap, 10% plastics/paper, and 0.192 pound (lb.) of dU/lb. of waste detonated.

An EPA-type gaussian plume model was employed with a puff type release function to simulate the airborne release resulting from the explosive treatment of the waste. The worst-case waste treatment and receptor location was used in the scenario, or a 2,000-lb. treatment at TA-36. Multiple treatments were used for comparison to those standards having 7-day or more averaging periods. Release heights and release fractions for a typical 50 lb. explosive "shot" were determined by Church's method and are shown in Table I below[2]. Airborne effluents were assumed to be transported directly to the potential receptors, using median dispersion factors for the Los Alamos area. The modeled concentration values for the above scenario are provided in Table II below.

Table I. Detonation Cloud Height and Material Distribution

Height (meters)	Release Fraction
162	20%
121	35%
81	35%
40	16%
0	4%

[1]Hazardous Air Pollutant (HAP) emission standards are regulated under Title 20, Chapter 2, Part 70 of the New Mexico Administrative Code for the facility at 10 tons per year for any one HAP or 25 tons per year for any combination of HAPs. Subsequently, impacts for hydrogen chloride and hydrogen fluoride releases were not included in this modeling analysis.

[2]"Cloud Rise from High-Explosives Detonations, Sandia Laboratories," H.W. Church, June 1969, TID-4500, (53rd ed., UC-41, Health and Safety, SC-RR-68-903).

Table II. Air Quality Impacts from Explosive Destruction of Waste

Chemical	Ambient Air Quality Standards			Air Concentrations at: Pajarito Road (800 m NNE)	White Rock (2980 m ESE)
Carbon monoxide	8-hour average 1-hour average	0.5 mg/m^3 2.0 mg/m^3	(8.7 ppm) (13.1 ppm)	0.02 mg/m^3 0.16 mg/m^3	0.01 mg/m^3 0.02 mg/m^3
Nitrogen oxides	24-hour average annual arithmetic average	5.0 µg/m^3 1.0 µg/m^3	(0.1 ppm) (0.05 ppm)	5.25E-04 µg/m^3 1.15E-05 µg/m^3	1.96E-04 µg/m^3 4.29E-06 µg/m^3
Particulate matter	24-hour average 7-hour average 30-day average	150 µg/m^3 110 µg/m^3 90 µg/m^3		1.4 µg/m^3 0.39 µg/m^3 0.37 µg/m^3	0.51 µg/m^3 0.15 µg/m^3 0.14 µg/m^3
Sulfur dioxide	24-hour average annual arithmetic average	5.0 µg/m^3 1.0 µg/m^3	(0.1 ppm) (0.02 ppm)	0.054 µg/m^3 0.001 µg/m^3	0.020 µg/m^3 0.000 µg/m^3
Lead	3-month average	0.03 µg/m^3		4.3E-6 µg/m^3	1.6E-6 µg/m^3
Photo Chemical Oxidants (VOC)	1-hour average	245 µg/m^3	0.06 ppm	130 µg/m^3	48 µg/m^3
depleted Uranium	annual maximum	10 mrem		NA	>0.001 mrem

Footnotes:
m NNE = meters north-northeast
m ESE = meters east-southeast
mg = milligrams
m^3 = cubic meters
ppm = parts per million
µg = microgram
VOC = volatile organic compound
mrem = millirem
NA = not applicable

5.0 PROCEDURES TO PREVENT HAZARDS

The information provided in this section is submitted in accordance with the applicable requirements of the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), revised November 1, 1995, for the following subject areas:

- Security procedures and equipment [20 NMAC 4.1, Subpart IX, 270.14(b)(4), and 20 NMAC 4.1, Subpart V, 264.14, revised November 1, 1995];
- Access control [20 NMAC 4.1, Subpart IX, 270.14(b)(19)(viii), revised November 1, 1995];
- Preparedness and prevention requirements [20 NMAC 4.1, Subpart V, Part 264, Subpart C, revised November 1, 1995];
- Procedures, structures, and equipment for preventing hazards [20 NMAC 4.1, Subpart IX, 270.14(b)(8), revised November 1, 1995];
- General waste management practices for ignitable, reactive, and incompatible waste [20 NMAC 4.1, Subpart IX, 270.14(b)(9), and 20 NMAC 4.1, Subpart V, 264.17, revised November 1, 1995].

5.1 SECURITY [20 NMAC 4.1, Subpart IX, 270.14(b)(4) and 270.14(b)(19)(viii); 20 NMAC 4.1, Subpart V, 264.14]

The following describes the security features in place at the thermal treatment units located at Technical Area (TA) 14, TA-15, TA-36, and TA-39 at Los Alamos National Laboratory (LANL), in accordance with the requirements of 20 NMAC 4.1, Subpart IX, 270.14(b)(4) and 270.14(b)(19)(viii), and 20 NMAC 4.1, Subpart V, 264.14, revised November 1, 1995.

In compliance with LANL standard operating procedures (SOP) for the open burning/open detonation (OB/OD) thermal treatment units (see Appendix B for SOPs), manned roadblocks are established along access roads in the vicinity of the OB/OD units to further reduce the possibility of entry into these areas during actual treatment operations. Personnel manning the roadblocks maintain two-way radio contact with administrative controls and firing site personnel and can stop the operation should a breach of security occur. In accordance with 20 NMAC 4.1, Subpart IX, 270.14(b)(19)(viii), revised November 1, 1995, the locations of security fences and entry/access gates in the vicinity of these units are shown on Figures 5-1 through 5-5. Collectively, these security procedures and the security features discussed below prevent the unknowing entry and minimize the possibility for unauthorized entry of persons into the OB/OD thermal treatment units in accordance with the requirements of 20 NMAC 4.1, Subpart V, 264.14(b)(2), revised November 1, 1995.

The OB/OD thermal treatment units at TA-14, TA-15, TA-36, and TA-39 are located within secured areas at which security is maintained through both administratively controlled and physical barriers. Access to the areas can only be gained through controlled entry stations at TA-16, TA-36, and TA-69 and through key-activated entry gates within TA-15 by persons possessing appropriate security clearance. Entry stations are located on Anchor Ranch Road for access through TA-69 off of West Jemez Road for access through TA-16, and on Potrillo Drive at TA-36 for access through TA-18 and TA-36 via Pajarito Road, respectively. The entry stations are manned by Protection Technology Los Alamos security personnel 24 hours a day. In addition, an 8-foot-high chain-link security fence with razor wire at the top surrounds the entire perimeter of TA-14, TA-15, TA-36, and TA-39. The entire security fence is also inspected on a regular basis by security personnel, and repairs are made, as necessary. Warning signs are posted at the entrance to each OB/OD thermal treatment unit area and can be seen by personnel approaching the area. The legend on the signs indicates "Danger Explosives Area." Signs reading "Authorized Personnel Only" are posted on gates on interior access roads at each TA in the vicinity of a thermal treatment unit. All warning signs are legible from a distance of 25 feet and are written in English and Spanish.

5.2 PREPAREDNESS AND PREVENTION REQUIREMENTS [20 NMAC 4.1, Subpart V, Part 264, Subpart C]

The following sections present how operations at the TA-14, TA-15, TA-36, and TA-39 OB/OD thermal treatment units comply with the preparedness and prevention requirements of 20 NMAC 4.1, Subpart V, Part 264, Subpart C, revised November 1, 1995.

5.2.1 Required Equipment [20 NMAC 4.1, Subpart V, 264.32]

In accordance with the requirements of 20 NMAC 4.1, Subpart V, 264.32, revised November 1, 1995, the thermal treatment units addressed in this Part B permit application are equipped with adequate emergency equipment, which includes internal and external communication equipment; alarm systems; fire extinguishers; and fire control, spill control, and decontamination equipment. Emergency equipment specific to the OB/OD thermal treatment units at TA-14, TA-15, TA-36, and TA-39 is discussed in the following sections and is summarized in Attachment 7-1 of this Part B permit application. LANL-wide emergency equipment, available for use at any of the LANL waste management units, is presented in Section 7.0 of the LANL General Part B.

Alarm systems are in place at the OB/OD thermal treatment units at TA-14, TA-15, TA-36, and TA-39 and are used to alert personnel to clear the areas. The alarm systems, which consist of sirens and red flashing lights, are activated prior to and during treatment operations. The sirens are also sounded at the completion of treatment operations to signal that an area is clear. In addition, emergency "kill" switches are located at the OB/OD thermal treatment units and may be activated by any personnel to halt operations in the event of abnormal or unusual conditions. Fire alarm pull stations are located in TA-15-184, TA-15-185, TA-15-186, and TA-15-310; in TA-36-8; and in TA-39-6 and TA-39-57. These pull stations can be accessed by personnel working at the OB/OD thermal treatment units. Upon activation of the fire alarm system, an audible alarm sounds to alert personnel of emergency conditions. Manual pull stations are connected to the Los Alamos County Fire Department (LACFD) through LANL's central alarm system (see Section 7.0 of the LANL General Part B) at all times.

Paging and conventional telephones are available during treatment operations at the OB/OD thermal treatment units to provide adequate communication and to summon external emergency assistance, if necessary. Telephones are located at the control bunkers and in the control buildings. These telephones have paging capabilities and may be used in an emergency to communicate the location and nature of hazardous conditions to personnel in the area.

Fire extinguishers available for use at the TA-14 OB/OD thermal treatment units are located at TA-14-6 and TA-14-23. Two fire extinguishers are located at TA-14-6, and five fire extinguishers are located at TA-14-23. Two portable Halon fire extinguishers are located in vehicles at TA-15-310. Two fire extinguishers are located in TA-36-8, and a fire extinguisher is located in each control building at TA-39 (TA-39-6 and TA-39-57). In addition, each vehicle used to transport explosives is equipped with a Halon fire extinguisher. Depending on the size of the fire and the fuel source, fire extinguishers may be used by on-site personnel. However, LANL policy encourages immediate evacuation of the area and notification of appropriate emergency personnel.

One fire hydrant is located at the TA-14 entry gate. One fire hydrant is located at the entrance to TA-15-186, which is approximately 200 feet southeast of the OD thermal treatment unit at TA-15-184. One fire hydrant is also located near TA-39-98. Water is supplied to these fire hydrants by a municipal water system through 8-inch pipes at an adequate volume and pressure (i.e., 200 gallons per minute and 90 pounds per square inch static pressure) to supply a water hose in the event of a fire, as required by 20 NMAC 4.1, Part V, 264.32(d), revised November 1, 1995.

Although permanent sources of water (i.e., a fire hydrant) are not available in the immediate vicinity of each thermal treatment unit, arrangements can be made with the LACFD to provide water tanker trucks to the site for use in an emergency. The water tanker trucks are capable of supplying water at adequate volume and pressure for use in fire-suppression activities to meet the requirements of 20 NMAC 4.1, Part V, 264.32(d), revised November 1, 1995. SOPs are in place that describe when and how fire department assistance is to be used.

Spill control equipment is available at TA-14-23, TA-15-184, TA-39-6, and TA-39-57. This equipment consists of various types of sorbents. Spill control equipment is not currently available at the TA-36-8 OD thermal treatment unit. This equipment is available at the lower Slobbovia Site at TA-36 but would not be easily accessible to personnel at TA-36-8.

Eyewash stations are located in TA-14-23, TA-15-185, and TA-36-8. Personnel decontamination equipment available at TA-36-8 includes a portable eyewash station located in the main chamber of TA-36-8. Two self-contained breathing apparatus are also located in TA-36-8. A portable eyewash station is available for use at TA-39-6 and TA-39-57.

Material safety data sheets (MSDS), which provide useful exposure information, are available at the group office. MSDSs, first aid kits, and hearing protection equipment are also available at the OB/OD thermal treatment units located at TA-14, TA-15, TA-36, and TA-39.

5.2.2 Testing and Maintenance of Equipment [20 NMAC 4.1, Subpart V, 264.33]
Communications and alarm systems, and fire protection, spill control, and decontamination equipment located at the OB/OD thermal treatment units addressed in this Part B permit application are tested and/or maintained according to the inspection schedule detailed in

Section 6.0 of this document and in Section 6.0 of the LANL General Part B. The frequency of inspection is adequate to assure proper operation in the event of an emergency. Repair and replacement of emergency equipment are performed as required.

5.2.3 Access to Communications or Alarm System [20 NMAC 4.1, Subpart V, 264.34]

Whenever treatment operations are being conducted at the OB/OD thermal treatment units addressed in this Part B permit application, involved personnel have immediate access to an emergency communication device, either directly or through visual or voice contact with another individual. In the event of an emergency, communication equipment at the OB/OD thermal treatment units allows personnel to contact the Dynamic Experimentation operating group management, the Emergency Management and Response Office, and/or the Central Alarm Station operator (refer to Section 7.2 of the LANL General Part B). In addition to the communications and alarm systems described in this section, two-way radios, pagers, and/or cellular telephones are also used at the OB/OD thermal treatment units to provide additional means of communication between on-site personnel and/or to contact LANL emergency support personnel.

5.2.4 Aisle Space Requirements [20 NMAC 4.1, Subpart V, 264.35]

At the OB/OD thermal treatment units addressed in this Part B permit application, adequate space is maintained to allow the unobstructed movement of personnel and fire protection, spill control, and decontamination equipment in the event of an emergency.

5.2.5 Support Agreements with Outside Agencies [20 NMAC 4.1, Subpart V, 264.37]

Information on support agreements with outside agencies, as required by 20 NMAC 4.1, Subpart V, 264.37, revised November 1, 1995, is presented in Section 5.0 of the LANL General Part B.

5.3 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT [20 NMAC 4.1, Subpart IX, 270.14(b)(8)]

Descriptions of the preventive procedures, structures, and equipment at the OB/OD thermal treatment units at TA-14, TA-15, TA-36, and TA-39 are presented below. This information is provided in accordance with the requirements of 20 NMAC 4.1, Subpart IX, 270.14(b)(8), revised November 1, 1995. Adherence to the procedures and proper use of the structures and equipment will help to prevent hazards, prevent undue exposure of personnel to hazardous waste, and prevent releases to the environment.

At the TA-14, TA-15, TA-36, and TA-39 OB/OD thermal treatment units, large containers of explosives-contaminated waste or explosive materials are typically handled using mechanical equipment such as a truck-mounted crane or a hydraulic lift gate. If the waste is not immediately detonated, it is placed in a temporary staging area, such as a satellite accumulation or less-than-90-day accumulation area, in accordance with generator regulations. Small containers of waste are handled manually or with a dolly. The use of proper handling equipment, appropriate to a container's size and weight, helps to prevent hazards while moving containers at a thermal treatment unit. Additionally, personnel involved in waste handling and container handling operations at the OB/OD thermal treatment units are knowledgeable of the physical and chemical properties of the waste managed at the site and take additional precautions, as necessary, to ensure that containers are handled safely.

Pursuant to the requirements of 20 NMAC 4.1, Subpart IX, 270.14(b)(19)(xi), revised November 1, 1995, Maps 2 through 5 of the OB/OD Part A (LANL, 1997) show surface contours and drainage around the OB/OD thermal treatment units. Engineering controls (i.e., earthen berms) are in place at the OB/OD units to prevent runoff of wastes from the unit to other areas of the facility or to the environment.

For several reasons, it is not anticipated that there will be any impact to groundwater or other water supplies as a result of treatment operations at the OB/OD thermal treatment units. The depth to groundwater at LANL ranges from 600 feet to 1,200 feet (see Figure 2-7 of the LANL General Part B). Geologic units underlying the area include layers of unsaturated volcanic tuff and ash, the moisture content of which is generally less than 10 percent (Daniel B. Stephens & Associates, Inc., 1995). Because the moisture content is insufficient for moisture migration through the Bandelier Tuff, no impact to groundwater is expected. In addition, all water supply lines are under pressure and are equipped with backflow prevention devices.

Electrical power is supplied to buildings near each of the OB/OD thermal treatment units. Supplied power at these buildings is used to operate lighting and telephone and alarm systems.

Operations at the OB/OD thermal treatment units would be discontinued temporarily if electrical power was not restored quickly or if container handling equipment failed.

Safety shoes, safety glasses, and other personal protective equipment (PPE) required in explosives areas are worn by workers during routine operations at the thermal treatment units. Additional appropriate PPE is available should abnormal or unusual conditions require such equipment.

Releases to the atmosphere resulting from treatment activities at the OB/OD thermal treatment units cannot be prevented. However, assuming a conservative scenario of treatment activities at the unit (as discussed in Section 4.6.4 of this Part B permit application), estimated resulting emissions will not exceed regulatory levels and, therefore, will not adversely affect human health or the environment.

5.4 PREVENTION OF ACCIDENTAL IGNITION OR REACTION OF IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTE [20 NMAC 4.1, Subpart IX, 270.14(b)(9), 270.15(c) and (d) and 20 NMAC 4.1, Subpart V, 264.17, 264.176, and 264.177]

This section details the precautions taken to prevent accidental ignition or reaction of ignitable, reactive, or incompatible wastes at the OB/OD thermal treatment units at TA-14, TA-15, TA-36, and TA-39.

Ignitable and/or reactive wastes may be temporarily stored in containers and managed in accordance with generator regulations at the OB/OD thermal treatment units at TA-14, TA-15, TA-36, and TA-39. Containers holding ignitable or reactive wastes are or will be located at least 50 feet from the facility's property line at all times (refer to Maps 1 through 5 of LANL's OB/OD Part A) and will be protected from sources of ignition or reaction. Policies and SOPs are in place at the OB/OD thermal treatment units that minimize the possibility of accidental ignition. In addition, smoking is not permitted in areas where ignitable and/or reactive wastes are managed. Signs indicating "No Smoking Except in Designated Areas" are conspicuously placed at the entrances to the OB/OD thermal treatment units, as required by 20 NMAC 4.1, Subpart V, 264.17(a), revised November 1, 1995. Together, these measures meet the requirements of 20 NMAC 4.1, Subpart V, 264.17(a) and (b) and 264.176, revised November 1, 1995.

Incompatible wastes, if managed at the OB/OD thermal treatment units, are segregated to prevent adverse reactions from occurring through commingling of the wastes. In addition, no incompatible wastes will be mixed, and no waste will be placed in a container that previously held an incompatible waste, as required by 20 NMAC 4.1, Subpart V, 264.177(a) and (b), and 20 NMAC 4.1, Subpart IX, 270.15(d), revised November 1, 1995. If incompatible wastes are managed at any of the OB/OD thermal treatment units, the requirements of 20 NMAC 4.1, Subpart V, 264.177(c), revised November 1, 1995, will also be met. Only containers made of or lined with materials that will not react with and are otherwise compatible with the waste to be managed will be used at the OB/OD thermal treatment units.

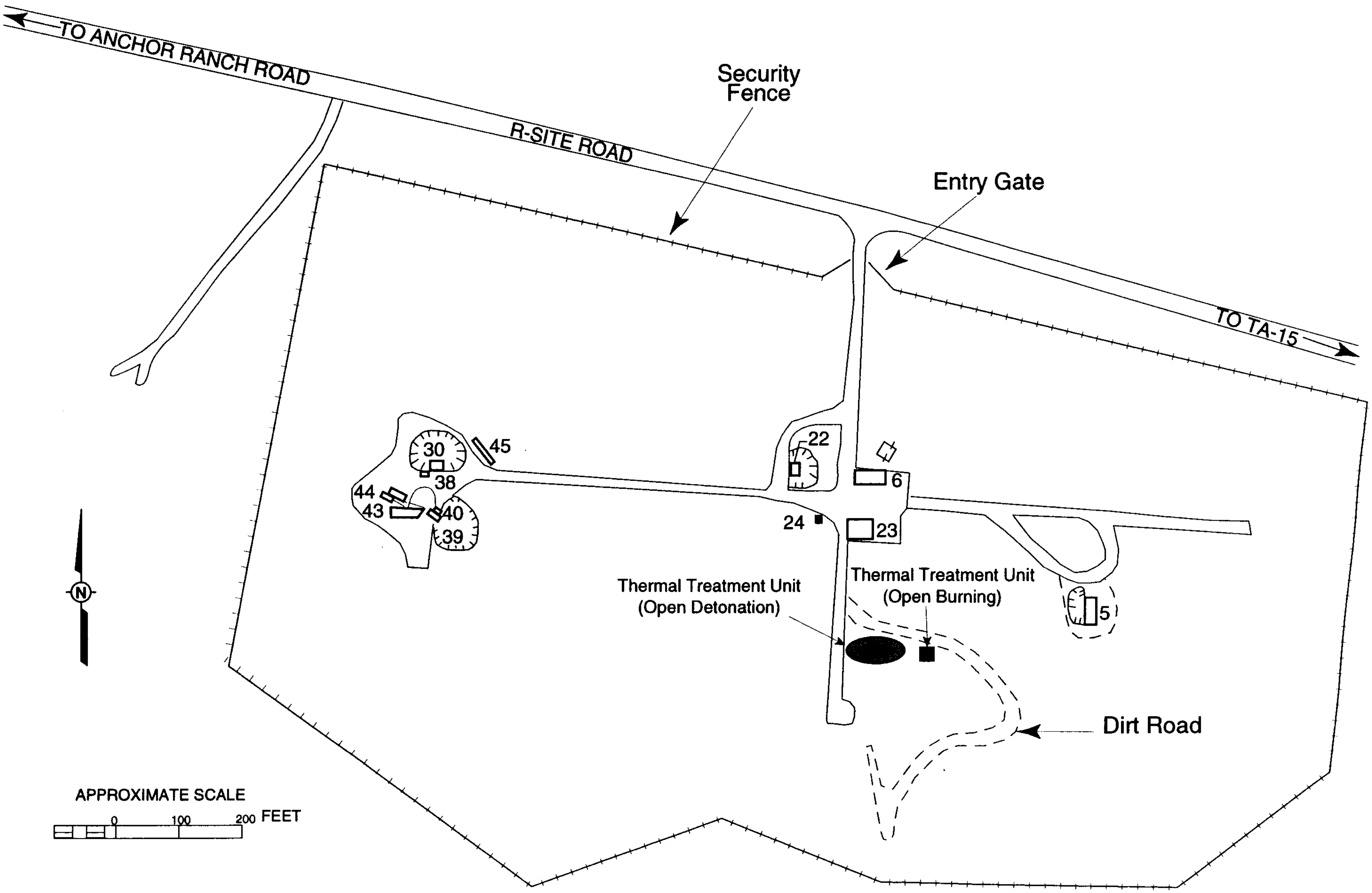


Figure 5-1
Location Map Showing Security Fence and Entry Gates in the Vicinity of the Thermal Treatment Units near Technical Area (TA) 14, Building 23

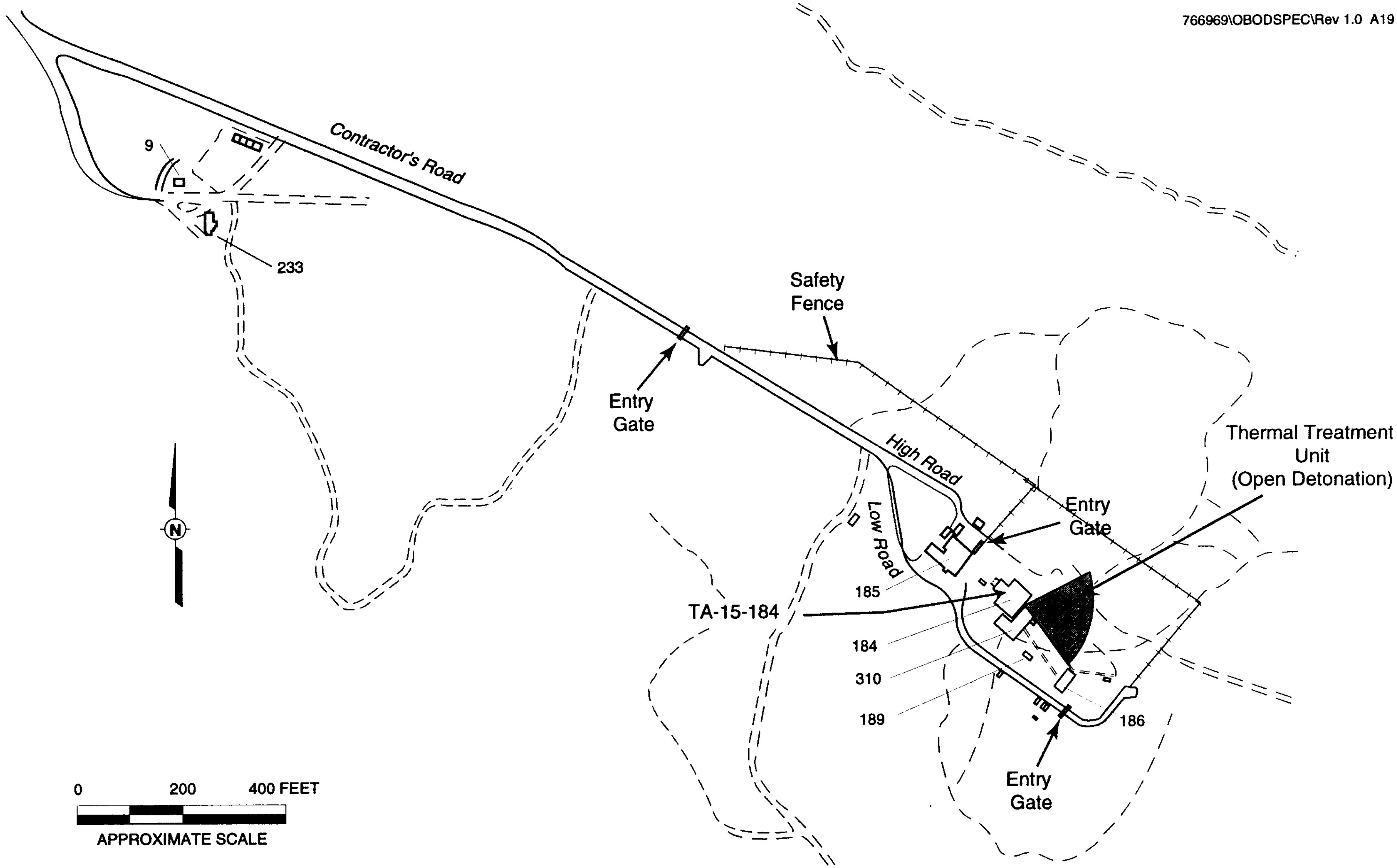


Figure 5-2
Location Map Showing Security Fence and Entry Gates
in the Vicinity of the Thermal Treatment Unit near Technical Area (TA) 15, Building 184

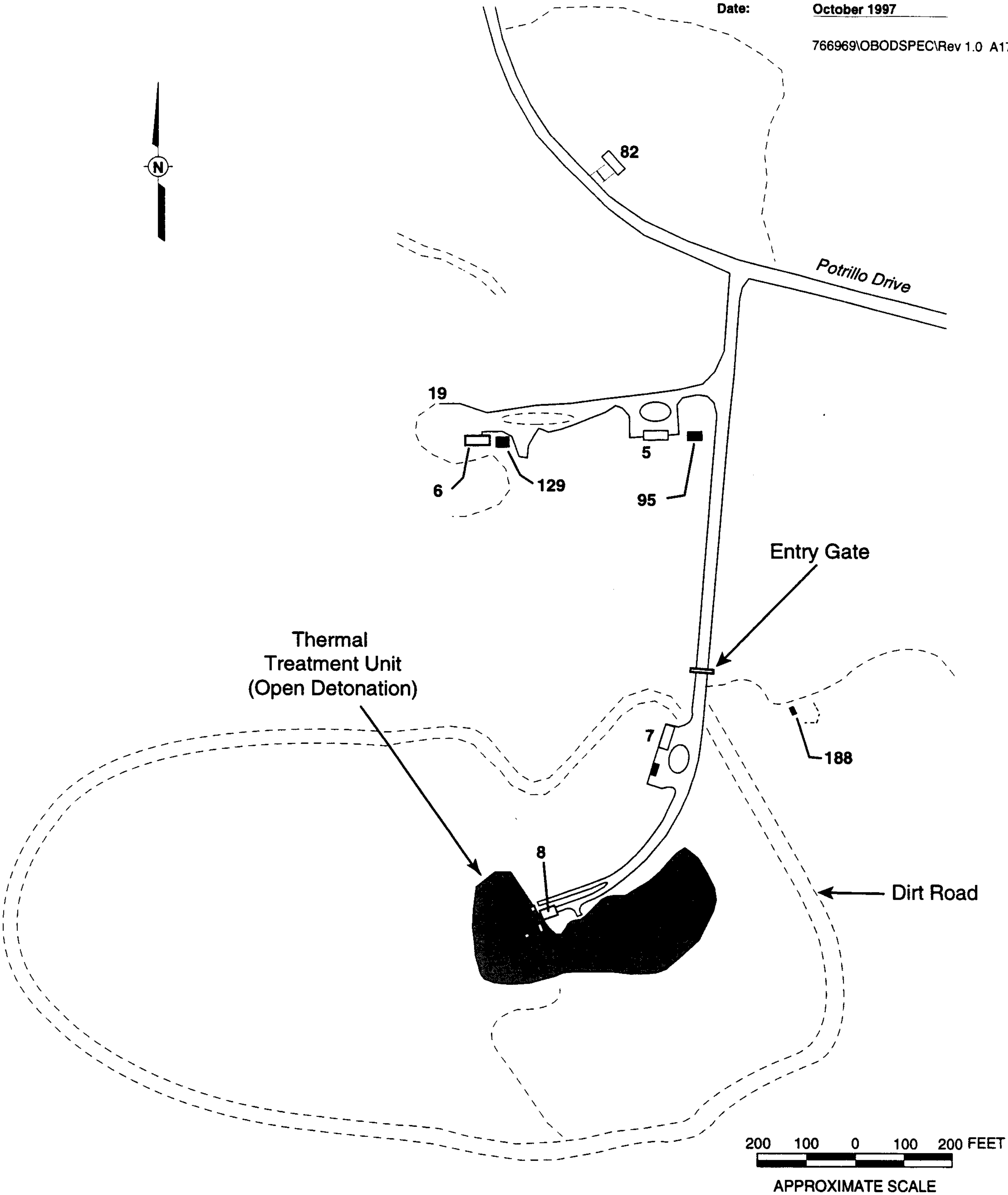


Figure 5-3
Location Map Showing Entry Gate in the Vicinity of the Thermal Treatment Unit
near Technical Area 36, Building 8

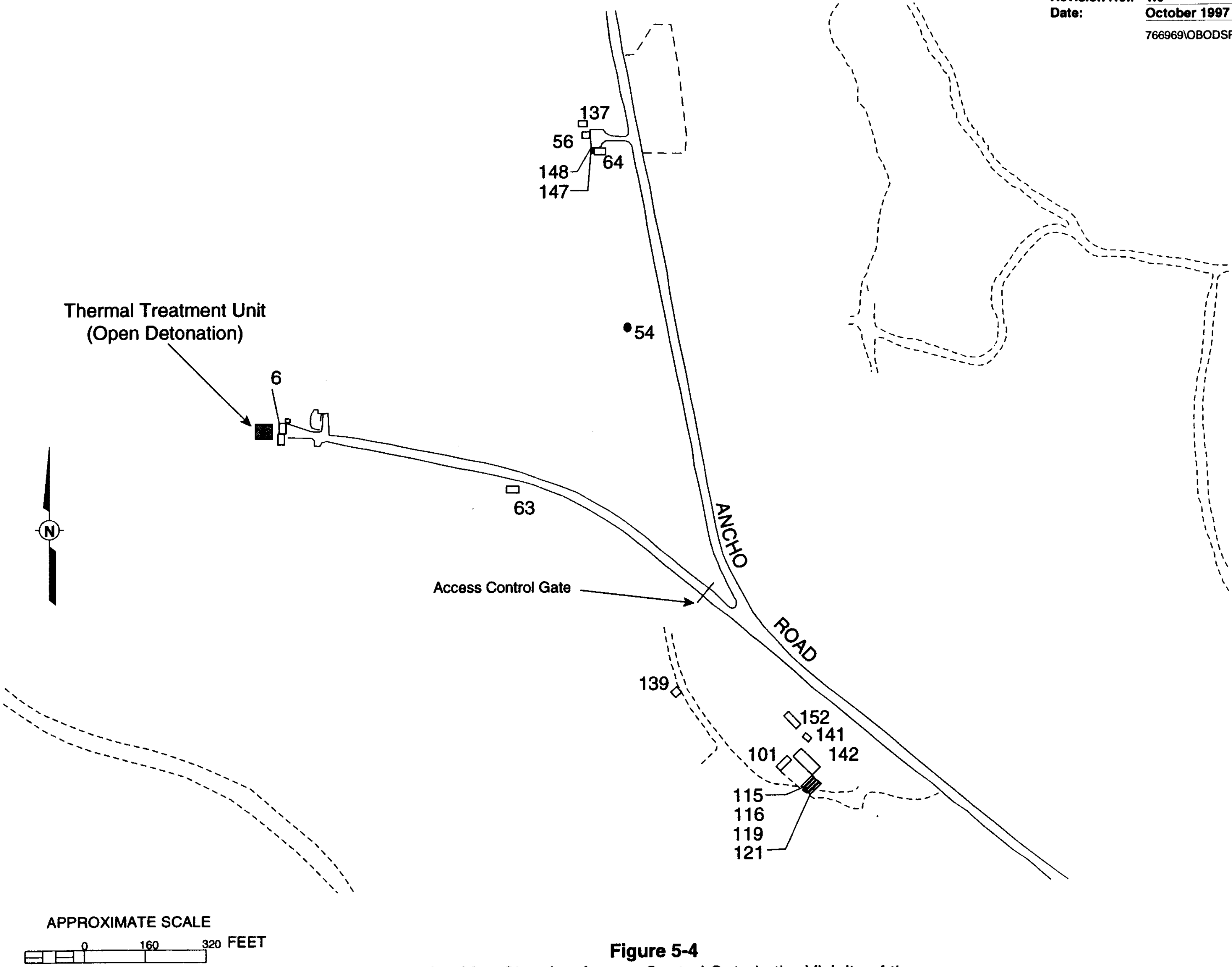


Figure 5-4
Location Map Showing Access Control Gate in the Vicinity of the Thermal Treatment Unit near Technical Area 39, Building 6

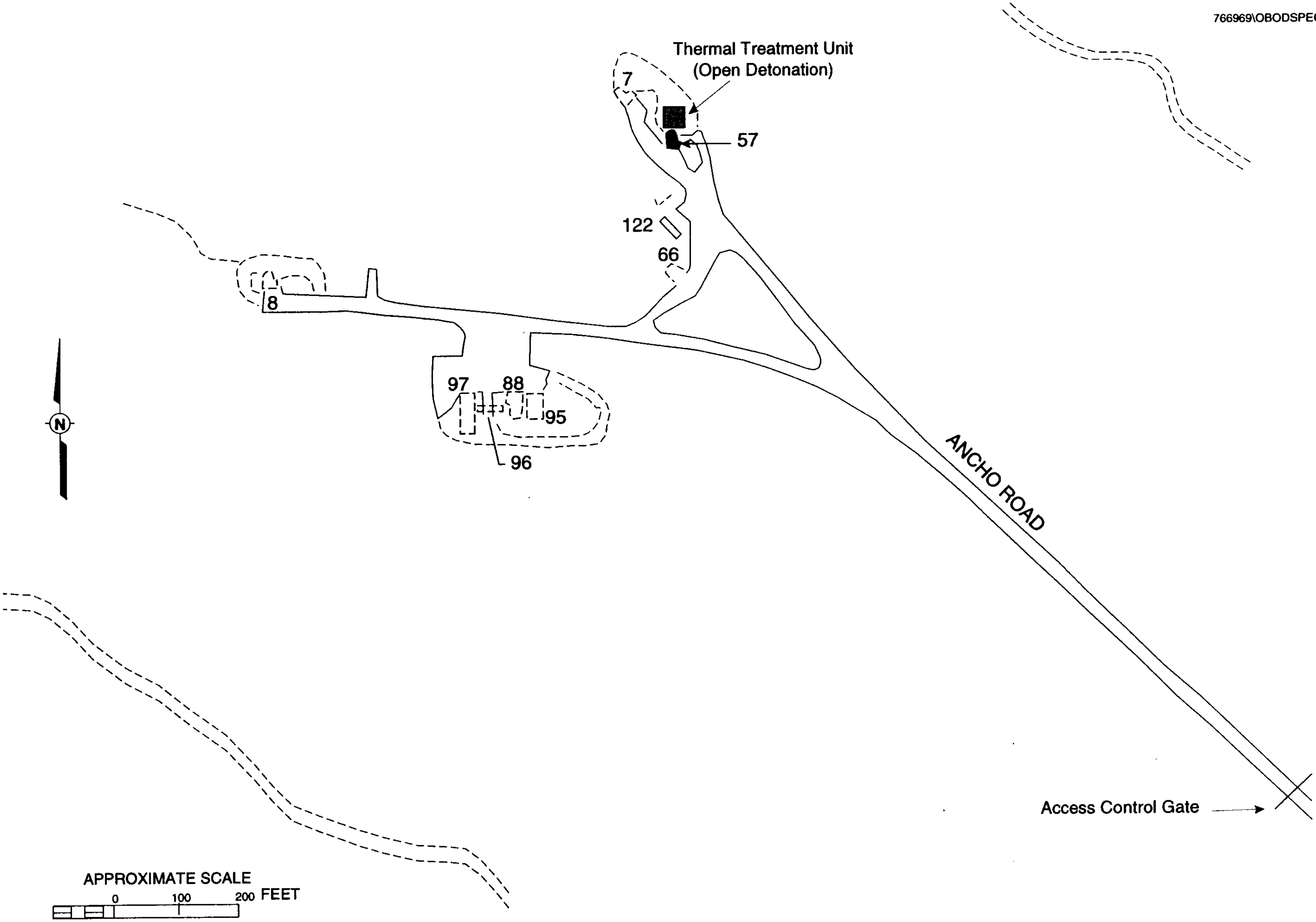


Figure 5-5
Location Map Showing Access Control Gate in the Vicinity of the Thermal Treatment Unit near Technical Area 39, Building 57

6.0 INSPECTION PLAN

In accordance with the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), Subpart V, 264.15, "General Inspection Requirements," revised November 1, 1995, this section presents inspection requirements applicable to the open burning/open detonation (OB/OD) thermal treatment units at Los Alamos National Laboratory (LANL). Pursuant to 20 NMAC 4.1, Subpart V, 264.15(a), revised November 1, 1995, inspection schedules for these units have been developed to identify equipment malfunctions and deterioration, operator errors, and discharges that might cause or lead to a release of hazardous waste and pose a threat to human health and the environment. This inspection plan, which presents general inspection schedules, as specified in 20 NMAC 4.1, Subpart IX, 270.14(b)(5), revised November 1, 1995, is being submitted with this unit-specific Part B permit application. Inspections are conducted often enough to identify problems in time to correct them before they harm human health or the environment.

6.1 GENERAL INSPECTION SCHEDULES AND REQUIREMENTS [20 NMAC 4.1, Subpart IX, 270.14(b)(5) and 20 NMAC 4.1, Subpart V, 264.15(b) and (c)]

In accordance with the requirements of 20 NMAC 4.1, Subpart IX, 270.14(b)(5), and 20 NMAC 4.1, Subpart V, 264.15(b)(1), revised November 1, 1995, a written inspection schedule has been developed at LANL. This schedule is followed for the inspection of monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment that are important to preventing, detecting, and responding to environmental or human health hazards. A copy of this inspection plan, which includes inspection schedules, and copies of inspection records are maintained at the facility by LANL's Hazardous and Solid Waste Group (ESH-19) and the site operator, as required in 20 NMAC 4.1, Subpart V, 264.15(b)(2) and 264.15(d), revised November 1, 1995.

Inspection schedules outlining the items to be addressed on LANL's Hazardous and Mixed Waste Facility Inspection Record Form (IRF) and inspection frequencies for the OB/OD thermal treatment units are provided in Section 6.2. Pursuant to 20 NMAC 4.1, Subpart V, 264.15(b)(3), revised November 1, 1995, the IRF lists the types of problems to be looked for during an inspection. The IRF and instructions for its completion are provided as Attachment 6-1 of the LANL General Part B (LANL, 1996a). The activities discussed below are addressed according to the specified regulatory requirements as well as to existing LANL inspection requirements for hazardous waste management units.

6.1.1 Inspection Records [20 NMAC 4.1, Subpart V, 264.15(d)]
Inspection training is provided through LANL's Environment, Safety, and Health Training Group, with guidance from ESH-19. Trained personnel assigned from the operating group that manages the unit conduct inspections and record the information on IRFs. These inspections are retained in inspection logbooks for a minimum of three years from the date of inspection. Copies of the inspection records are forwarded to ESH-19, who maintains copies of the inspection records for a minimum of three years from receipt.

If necessary, ESH-19 may modify the IRF used at LANL or may develop an equivalent form. Because the IRF is a comprehensive form that applies to all categories of both hazardous and mixed waste management units, not all sections of the form apply to all units. The IRF complies with 20 NMAC 4.1, Subpart V, Part 264, revised November 1, 1995, requirements for permitted hazardous waste management units; 20 NMAC 4.1, Subpart VI, Part 265, revised November 1, 1995, requirements; and additional requirements directed by LANL policy. Instructions included with the IRF provide specific guidance for each inspection item listed.

The IRF (Attachment 6-1 of the LANL General Part B) is completed according to the daily and weekly schedules provided in Section 6.2. In the event that the primary inspector is not available to complete the IRF, an alternate is responsible for its completion. Inspections are conducted and recorded in Parts I and II of the IRF for each working day or week (as appropriate) that waste is treated. For each working day or week that waste is not treated, a check mark is placed in the "No Use" block in Part I.

For every item requiring inspection, a response indicating the condition of each item is entered in the column under the appropriate day of the week. The response is either "OK" or "AR" (action required). If the response is "AR," the action required is noted in Part II of the IRF. Multiple "ARs" are numbered. If inspection results indicate that corrective measures are warranted, any and all actions taken (along with time, date, and other pertinent information) are recorded in Part II of the IRF and on all subsequent IRFs until corrective measures are completed. After corrective measures have been completed, the "Condition" column on the IRF is changed to "OK".

6.1.2 Inspection Frequency [20 NMAC 4.1, Subpart V, 264.15(b)(4)]

Inspection frequencies relevant to the OB/OD thermal treatment units are presented in Section 6.2. Inspection frequencies may be increased at the discretion of the operator or ESH-19, if unexpected malfunctions occur, or if an accelerated deterioration rate of containers, secondary containment systems, and/or equipment is detected.

6.1.3 Actions Resulting From Inspections [20 NMAC 4.1, Subpart V, 264.15(c)]

6.1.3.1 Preventive Action

If any defects, deterioration, damage, or potential hazards are discovered during an inspection, appropriate corrective measures (e.g., transfer of waste from defective container to an appropriate container in good condition, repair or replacement of nonfunctioning equipment and/or systems, or removal of any accumulated liquids) will be completed promptly to minimize further damage and prevent the need for emergency response. Any preventive action taken in response to an inspection will be noted on the IRF.

6.1.3.2 Remedial and Emergency Action

If a hazardous condition is imminent or has already occurred, remedial action will be taken immediately. The situation will be assessed by the group leader (or designee) responsible for the unit. If this assessment indicates that human health or the environment may be adversely affected, the contingency plan (Sections 7.0 of the LANL General Part B and of this Part B permit application) will be implemented immediately. The contingency plan discusses the appropriate responses to emergency situations. Evacuation determinations will be made as outlined in Table 7-4 of the LANL General Part B. In the event the contingency plan is implemented, any sampling, decontamination, and verification will be conducted as specified in that plan.

6.2 INSPECTION SCHEDULE AND REQUIREMENTS FOR OB/OD THERMAL TREATMENT UNITS [20 NMAC 4.1, Subpart V, 264.15(b) and 264.602]

OB/OD thermal treatment units are inspected according to the schedule provided below. Inspection frequencies are adequate based on the deterioration rates of equipment/systems and the probability of harm to human health or the environment if failure of the equipment/systems occurs, or any operator error goes undetected between inspections.

6.2.1 Daily

Daily inspections will be conducted every day of operation (i.e., every day that OB/OD treatment occurs). For daily inspections of the thermal treatment units, the items in the following blocks on the IRF will be addressed, as appropriate:

Block Number	Item(s)
1–5	General information
7	(Un)loading area
13	Structural integrity of containers
14	Covers/lids of containers
16	Labels
18	Detonation pad run on/off control
22	Secondary containment structures
24	Appropriate container segregation
39	Radiation safety (if applicable)
40–48	General information

In addition, OD thermal treatment units will be inspected immediately before placement of wastes onto the site. After the unit can be safely approached following treatment, the area will be surveyed for unexploded ordnance and debris. All monitoring controls, emergency shutdown controls, and alarms or warning systems associated with the thermal treatment units will be inspected and/or tested for proper operating condition prior to the initiation of treatment at the units.

6.2.2 Weekly

Weekly inspections of OB/OD thermal treatment units, to be initiated on the first working day of each week, will address the items in the following blocks on the IRF, as appropriate:

Block Number	Item(s)
1–5	General information
8	Communication equipment
12	Eyewashes/safety showers
15	Warning signs
20	Security
21	Site lighting
25	Hose bibs, water supply
27	Road/work surfaces
28	Wind sock
33	Spill control, fire, and emergency equipment
40–48	General information

7.0 CONTINGENCY PLAN

In the event of an emergency at the open burning/open detonation (OB/OD) thermal treatment units at Technical Area (TA) 14, TA-15, TA-36, or TA-39, the Los Alamos National Laboratory (LANL)-wide contingency plan presented in Section 7.0 of the LANL General Part B (LANL, 1996a) will be implemented. Specific information on emergency response resources and release prevention/mitigation at TA-14, TA-15, TA-36, and TA-39 is provided below. Figures depicting evacuation routes and muster areas at each OB/OD thermal treatment unit are also provided in this Part B permit application. In addition, a listing of emergency equipment available for use at each OB/OD thermal treatment unit is included here as Attachment 7-1.

7.1 EMERGENCY RESPONSE RESOURCES

The Dynamics Experimentation (DX) Division is responsible for the hazardous waste thermal treatment units at TA-14, TA-15, TA-36, and TA-39. DX personnel have been trained in emergency procedures.

7.2 RESPONSIBILITY

At TA-14, TA-15, TA-36, and TA-39, DX Division is responsible for correction of a nonsudden release from a hazardous waste management unit if the correction can be performed safely with normal maintenance and management procedures. Personnel from the Emergency Management and Response Office may provide assistance in mitigating releases. Any correction methods for nonsudden releases that have resulted in an impact to the environment will be coordinated with the New Mexico Environment Department.

7.3 REMEDIAL ACTION

Contingency or emergency measures are unanticipated "fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste ..." for which a schedule of remedial actions cannot be reasonably ascertained. Any remedial actions carried out under the provisions of the contingency plan will be performed as soon as possible to ensure protection of human health and the environment, as described in Section 7.0 of the General Part B. As stated in the General Part B, these remedial actions include site cleanup; proper handling of recovered waste, contaminated soil, or contaminated surface water; decontaminating equipment, as needed; replacing or repairing equipment, as needed; and testing to verify successful cleanup.

DX Division personnel conduct regularly scheduled inspections at TA-14, TA-15, TA-36, and TA-39 to detect deterioration and/or failure of containment at the hazardous waste OB/OD thermal treatment units addressed in this Part B permit application. If an inspection reveals deterioration or failure, DX Division personnel ensure that maintenance or replacement is performed, as appropriate.

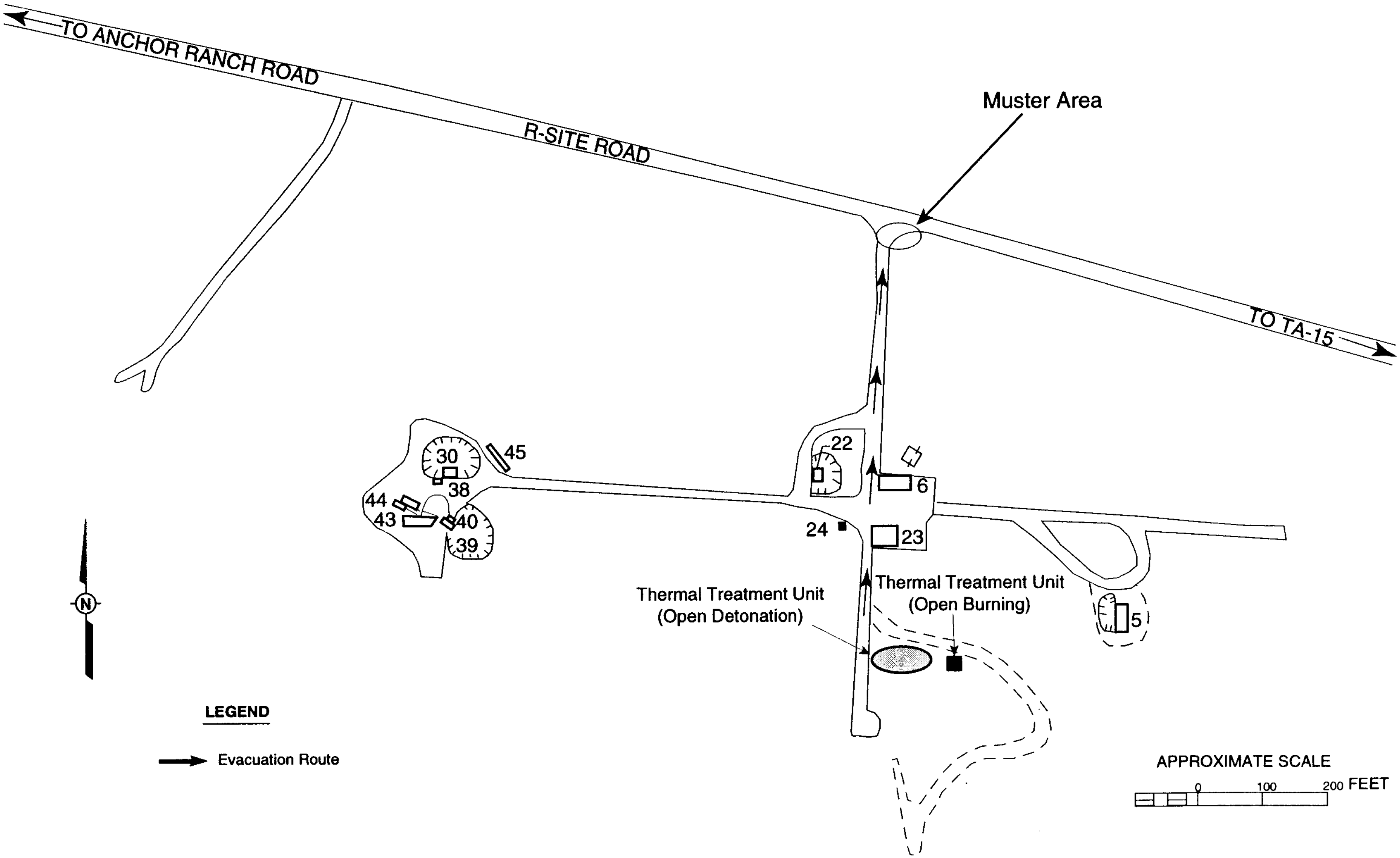


Figure 7-1
Evacuation Route and Muster Area for the Thermal Treatment Units near Technical Area (TA) 14, Building 23

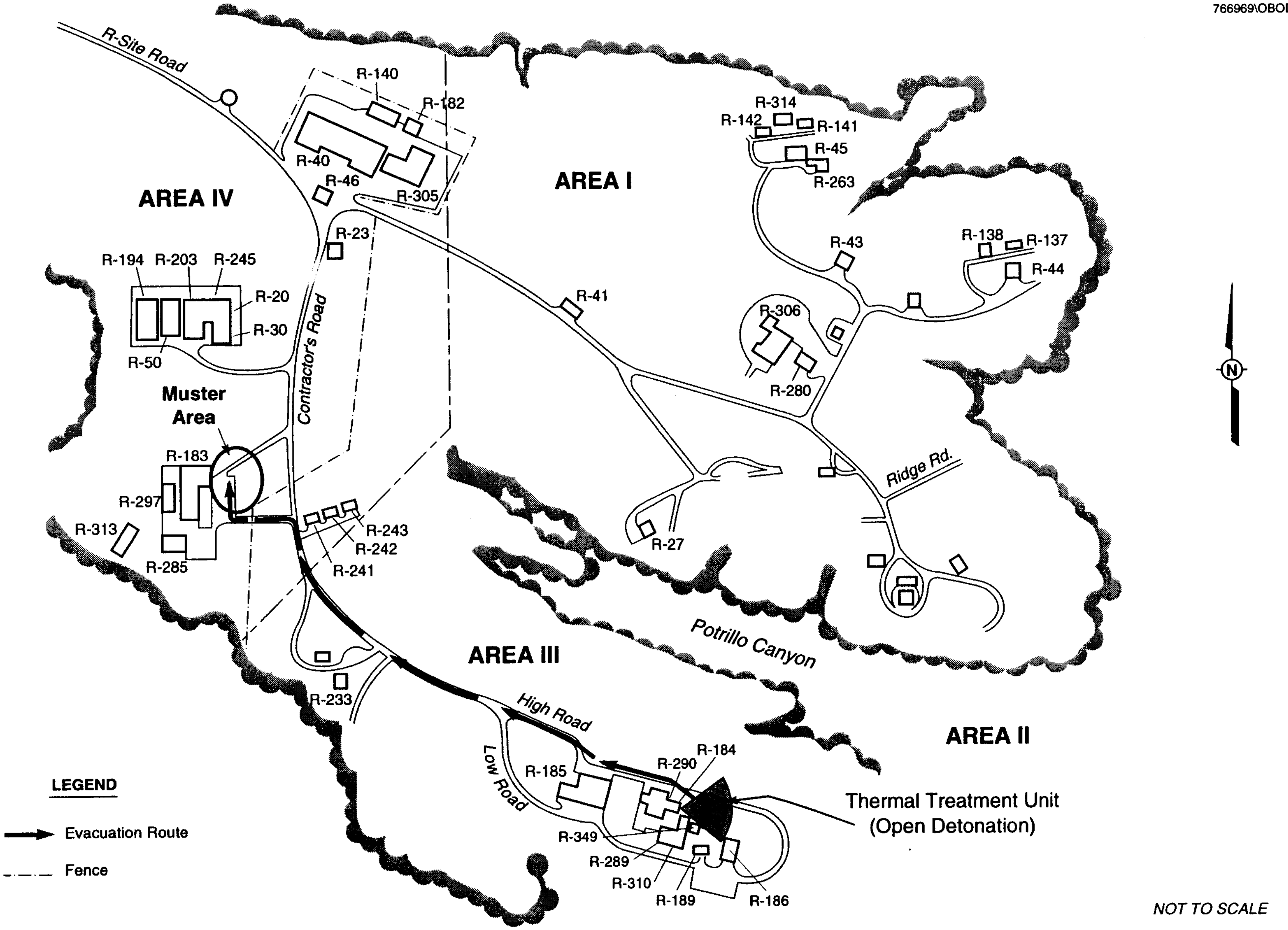


Figure 7-2
Evacuation Route and Muster Area for the Thermal Treatment Unit near Technical Area 15, Building 184

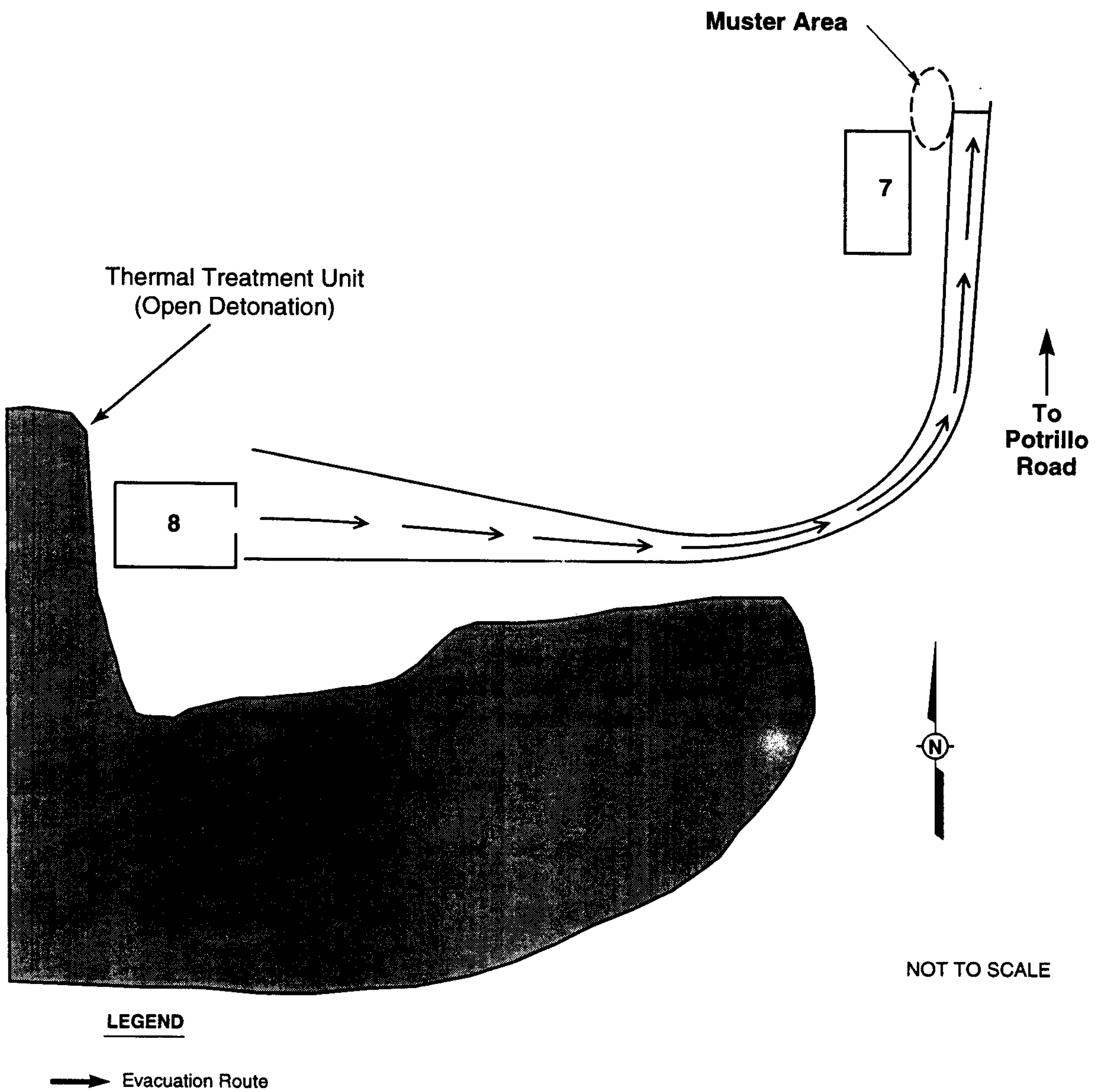


Figure 7-3

Evacuation Route and Muster Area for the Thermal Treatment Unit near Technical Area 36, Building 8

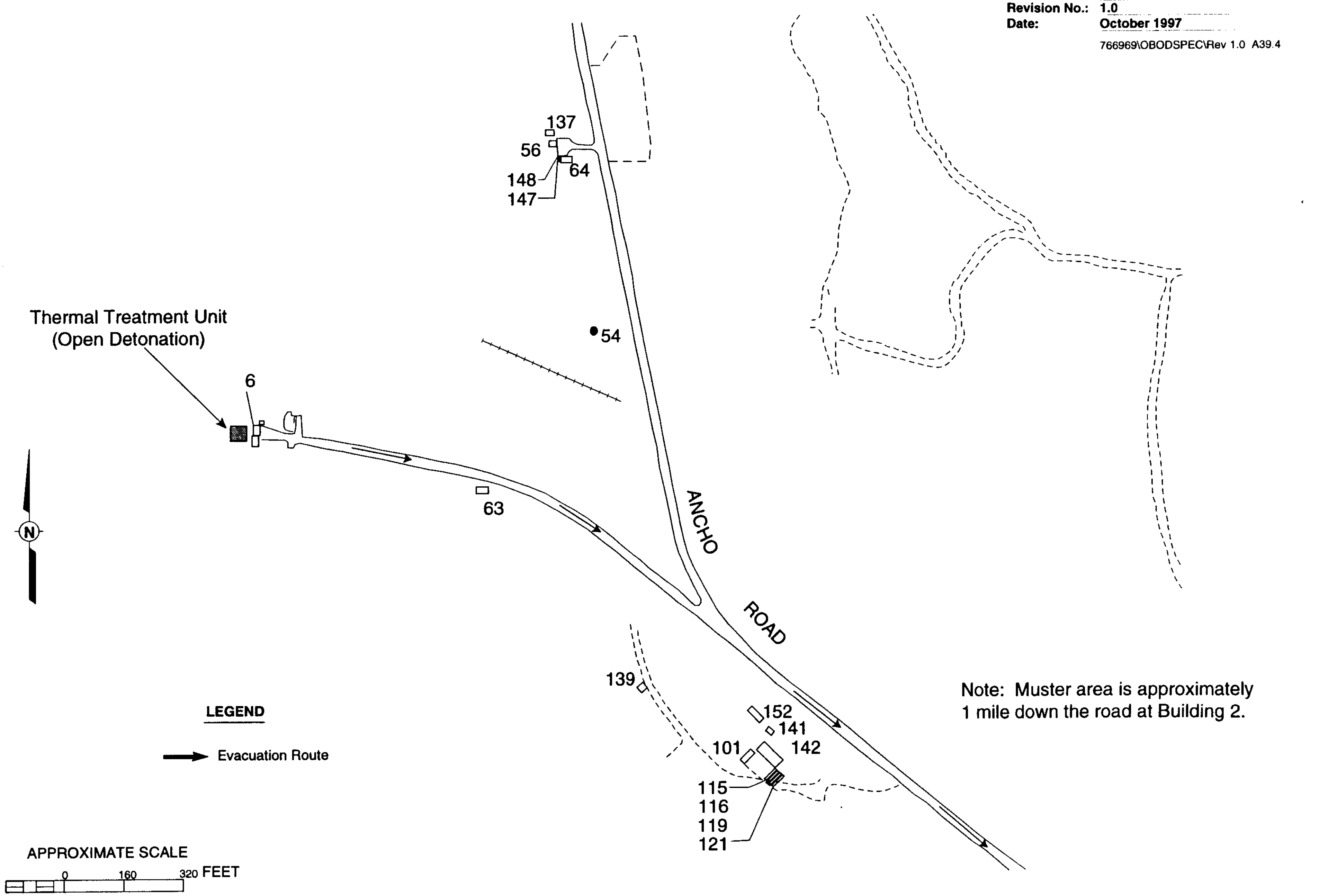


Figure 7-4
Evacuation Route and Muster Area for the Thermal Treatment Unit near Technical Area 39, Building 6

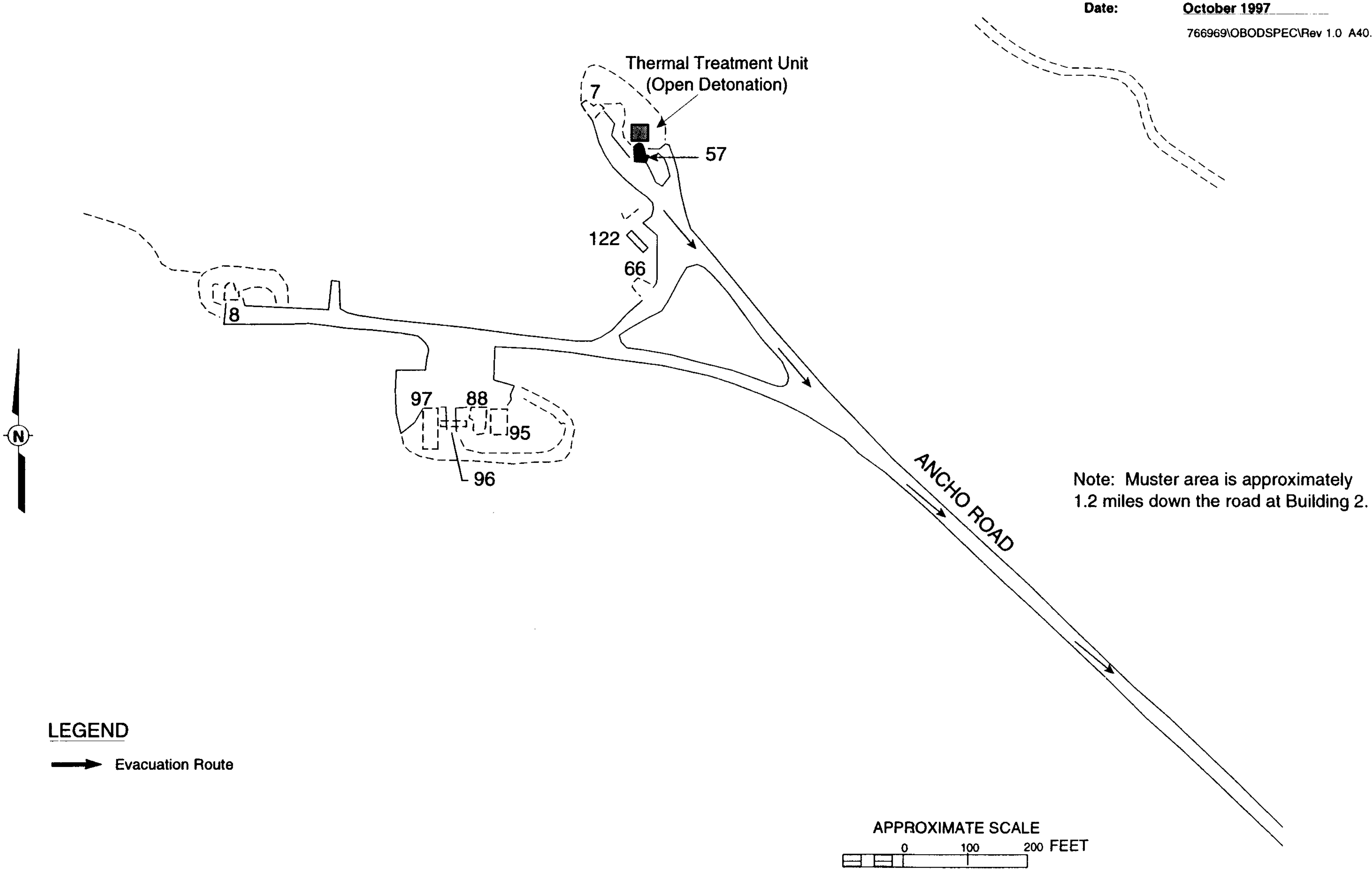


Figure 7-5
Evacuation Route and Muster Area for the Thermal Treatment Unit near Technical Area 39, Building 57

ATTACHMENT 7-1

Emergency Equipment

Attachment 7-1

Emergency Equipment

Emergency equipment available near Technical Area (TA) 14, Building 23 (TA-14-23) for personnel conducting activities at the TA-14 open burning/open detonation (OB/OD) thermal treatment units:

FIRE CONTROL EQUIPMENT:

Fire extinguishers

Locations:
One fire extinguisher is located in each vehicle used to transport explosive material.
Five fire extinguishers are located outside the control bunker (TA-14-23).
Two fire extinguishers are located outside TA-14-6.

Description of General Capabilities:
The fire extinguishers may be used by any employee in the event of a small fire. Fire extinguishers are never used to put out controlled fires at the OB/OD thermal treatment units.

A fire hydrant is located at the TA-14 entry gate.

Description of General Capabilities:
The fire hydrant supplies water at adequate volume and pressure to satisfy the requirements of the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), Part V, 264.32, revised November 1, 1995.

In the event that OB/OD thermal treatment may result in a potential fire hazard, local fire department personnel may be asked to stand by during treatment to control any fires that may be started.

SPILL CONTROL EQUIPMENT

Spill control equipment is located in a storage cabinet outside of TA-14-23.

Attachment 7-1

Emergency Equipment
(Continued)

Emergency equipment available near TA-14-23 for personnel conducting activities at the TA-14 OB/OD thermal treatment units (Continued):

COMMUNICATION EQUIPMENT:

Telephones (Centrex and private lines) are located at the control building (TA-14-23). Personnel also have access to two-way radios while at the OB/OD thermal treatment units.

A siren at TA-14 serves as an evacuation alarm.

Description of General Capabilities:
Telephones are used for internal and external communication and have paging capabilities. Two-way radios allow personnel in the field to maintain contact with various operations personnel and may be used to request emergency personnel and equipment, if necessary. The evacuation alarm, which consists of a siren, is used at the treatment unit to alert personnel to clear the area and/or to warn of test operations.

DECONTAMINATION EQUIPMENT:

An eyewash station is located in TA-14-23, Room 104.

Material safety data sheets (MSDS) are available in Room 101 at the control building (TA-14-23).

Description of General Capabilities:
The eyewash station may be used by personnel who receive a chemical splash to the skin or eyes. Specific MSDSs should be obtained prior to working with hazardous waste to determine if the application of water is indicated for decontamination.

PERSONAL PROTECTIVE EQUIPMENT:

First aid kits and hearing protection are located in TA-14-23.

OTHER:

See Attachment 7-1 of the Los Alamos National Laboratory (LANL) General Part B for equipment available in the Hazardous Materials (HAZMAT) Response Group (ESH-10) vehicles and trailers.

Attachment 7-1

Emergency Equipment
(Continued)

Emergency equipment available near TA-15-184 for personnel conducting activities at the TA-15 OD thermal treatment unit:

FIRE CONTROL EQUIPMENT:

Fire extinguishers

Locations:
Two vehicular-mounted Halon (ABC) fire extinguishers are located at the control bunker (TA-15-310).

Description of General Capabilities:
The fire extinguishers may be used by any employee in the event of a small fire.

Four fire alarm pull stations are located inside TA-15-184, TA-15-185, TA-15-186, and TA-15-310.

Description of General Capabilities:
Fire alarms may be activated by any employee in the event of a fire to notify the Central Alarm Station (CAS).

One fire hydrant is located near the entrance to TA-15-186.

Description of General Capabilities:
The fire hydrant supplies water at adequate volume and pressure to satisfy the requirements of 20 NMAC 4.1, Part V, 264.32, revised November 1, 1995.

In the event that thermal treatment may result in a potential fire hazard, local fire department personnel may be asked to stand by during OD to control any fires that may be started.

SPILL CONTROL EQUIPMENT:

Various types of sorbents are available at TA-15-185.

Attachment 7-1

Emergency Equipment
(Continued)

Emergency equipment available near TA-15-184 for personnel conducting activities at the TA-15 OD thermal treatment unit (Continued):

COMMUNICATION EQUIPMENT:

Telephones (Centrex and private lines) are located at TA-15-310 and at the control building (TA-15-185). Personnel have access to two-way radios while at the treatment unit. TA-15 is equipped with fire and evacuation alarms.

Description of General Capabilities:
Telephones are used for internal and external communication and have paging capabilities. Two-way radios allow personnel in the field to maintain contact with various operations personnel and may be used to request emergency personnel and equipment, if necessary. The fire alarm is activated in the event of a fire to notify the CAS. The evacuation alarm, which consists of horns and sirens, is used at the treatment unit to alert personnel to clear the area and/or to warn of test operations.

DECONTAMINATION EQUIPMENT:

An eyewash station is located at TA-15-185.

MSDSs are available at the group office (TA-15-183).

Description of General Capabilities:
The eyewash station may be used by personnel who receive a chemical splash to the skin or eyes. Specific MSDSs should be obtained prior to working with hazardous waste to determine if the application of water is indicated for decontamination.

PERSONAL PROTECTIVE EQUIPMENT:

First aid kits and hearing protection are located in TA-15-183.

OTHER:

See Attachment 7-1 of the LANL General Part B for equipment available in the HAZMAT vehicles and trailers.

Attachment 7-1

Emergency Equipment
(Continued)

Emergency equipment at TA-36-8 available for personnel conducting activities at the TA-36 OD thermal treatment unit:

FIRE CONTROL EQUIPMENT:

Fire extinguishers

Locations:
1 carbon dioxide (CO_2) fire extinguisher is located in the control bunker (TA-36-8).
1 water (A) fire extinguisher is located in TA-36-8.
A Halon (ABC) fire extinguisher is located in each vehicle (2 total) used to transport explosive material.

Description of General Capabilities:
These fire extinguishers may be used by any employee in case of a fire. The water fire extinguisher is for use on wood or brush fires. The CO_2 fire extinguisher is for use on electrical fires. The Halon fire extinguishers are for use in the event of an uncontrolled fire on the firing mound.

A fire alarm pull station is located in the main chamber of TA-36-8.

Description of General Capabilities:
Manually-operated fire alarms may be activated by any employee in the event of a fire to notify the CAS.

An automatic thermal alarm system is located in TA-36-8.

Description of General Capabilities:
Two alarms are connected to this system. One is located on the ceiling of the main chamber and one is located on the ceiling of the camera room.

In the event that thermal treatment may result in a potential fire hazard, local fire department personnel may be asked to stand by during OD to control any fires that may be started.

Attachment 7-1

Emergency Equipment
(Continued)

Emergency equipment at TA-36-8 available for personnel conducting activities at the TA-36 OD thermal treatment unit (Continued):

COMMUNICATION EQUIPMENT:

Telephones and two-way radios

Locations:
3 telephones are located inside the control bunker.
1 telephone is located at the firing mound.
1 two-way radio is located in the make-up building (TA-36-7).
1 two-way radio is located inside TA-36-8.
1 two-way radio is issued to each firing site vehicle.

Description of General Capabilities:
Telephones for internal and external communication are available for use by any employee.

Fire and evacuation alarms

Description of General Capabilities:
The fire alarm is activated in the event of a fire to notify the CAS. The evacuation alarm, which consists of horns and sirens, is used at the treatment unit to alert personnel to clear the area and/or to warn of test operations.

DECONTAMINATION EQUIPMENT:

An eyewash station and MSDSs are available in the main chamber of TA-36-8.

Description of General Capabilities:
The eyewash may be used by personnel who receive a chemical splash to the eyes. Specific MSDSs should be obtained prior to working with hazardous waste to determine if the application of water is indicated for decontamination.

PERSONAL PROTECTIVE EQUIPMENT:

Two self-contained breathing apparatus are located in TA-36-8. First aid kits and hearing protection are also located in TA-36-8.

OTHER:

See Attachment 7-1 of the LANL General part B for equipment available in HAZMAT vehicles and trailers.

Attachment 7-1

Emergency Equipment
(Continued)

Emergency equipment available at TA-39-6 and TA-39-57 for personnel conducting activities at the TA-39 OD thermal treatment units:

FIRE CONTROL EQUIPMENT:

Fire extinguishers

Locations:
One fire extinguisher is located in each vehicle used to transport explosive material. A fire extinguisher is located in each control building (TA-39-6 and TA-39-57).

Description of General Capabilities:
The fire extinguishers may be used by any employee in the event of a small fire. Fire extinguishers are never used to extinguish controlled fires at the thermal treatment units.

Fire alarm pull stations are located in TA-39-6 and TA-39-57.

Description of General Capabilities:
Fire alarms may be activated by any employee in the event of a fire to notify the CAS.

A fire hydrant is located near TA-39-98.

Description of General Capabilities:
The fire hydrant supplies water at adequate volume and pressure to satisfy the requirements of 20 NMAC 4.1, Part V, 264.32, revised November 1, 1995.

In the event that thermal treatment may result in a potential fire hazard, local fire department personnel may be asked to stand by during OD to control any fires that may be started.

SPILL CONTROL EQUIPMENT:

Various types of sorbents are available at TA-39.

Attachment 7-1

Emergency Equipment
(Continued)

Emergency equipment at TA-39-6 and TA-39-57 available for personnel conducting activities at the TA-39 OD thermal treatment units (Continued):

COMMUNICATION EQUIPMENT:

Telephones (Centrex and private lines) are located at the control buildings (TA-39-6 and TA-39-57). Personnel also have access to two-way radios while at the thermal treatment units.

Description of General Capabilities:
Telephones are used for internal and external communication and have paging capabilities. Two-way radios allow personnel in the field to maintain contact with various operations personnel and may be used to request emergency personnel and equipment, if necessary.

DECONTAMINATION EQUIPMENT:

Portable eyewashes are available for use at the TA-39 OD treatment units.

MSDSs are available at the control buildings (TA-39-6 and TA-39-57).

Description of General Capabilities:
The eyewash station may be used by personnel who receive a chemical splash to the skin or eyes. Specific MSDSs should be obtained prior to working with hazardous waste to determine if the application of water is indicated for decontamination.

PERSONAL PROTECTIVE EQUIPMENT:

First aid kits and hearing protection are located in TA-39-6 and TA-39-57.

OTHER:

See Attachment 7-1 of the LANL General Part B for equipment available in the HAZMAT vehicles and trailers.

8.0 PERSONNEL TRAINING PLAN

Personnel working at the open burning/open detonation thermal treatment units at Technical Area (TA) 14, TA-15, TA-36, and TA-39 will be trained appropriately, as discussed in Section 8.0 of the Los Alamos National Laboratory General Part B.

9.0 CLOSURE PLAN

This section describes the activities necessary to close the hazardous waste open burning/open detonation (OB/OD) thermal treatment units at Los Alamos National Laboratory (LANL) Technical Area (TA) 14, TA-15, TA-36, and TA-39 addressed in this Part B permit application. The activities detailed in this section are included to address the closure requirements specified in the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), Subpart IX, 270.14(b)(13), and 20 NMAC 4.1, Subpart V, Part 264, Subparts G and X, revised November 1, 1995. This closure plan addresses closure procedures specific to the OB/OD thermal treatment units.

General closure information applicable to all hazardous waste management units at LANL and general sampling and analytical procedures to be used during closure activities are presented in Section 9.0 of the LANL General Part B (LANL, 1996a).

9.1 CLOSURE PROCEDURES FOR THE OB/OD THERMAL TREATMENT UNITS [20 NMAC 4.1, Subpart V, 264.112; 20 NMAC 4.1, Subpart VI, 265.381]

The hazardous waste OB/OD thermal treatment units addressed in this Part B permit application are located at TA-14, TA-15, TA-36, and TA-39 at LANL. Figure 9-1 shows the locations of TAs within LANL. Figures 9-2 through 9-6 show the specific locations of the OB/OD thermal treatment units at the respective TAs. Detailed unit descriptions are provided in Section 4.0 of this Part B permit application. The closure schedule for the OB/OD thermal treatment units is outlined in Table 9-1. When LANL decides to close the OB/OD units, the existing closure plan will be revised to present detailed information, including procedures on removal of investigation-derived waste (e.g., contaminated soils, borehole cuttings, decontamination fluids). LANL typically revises closure plans to address conditions at the time of actual closure. The revised closure plan will be submitted to NMED for review and approval. The location and disposition of all wastes generated during closure will be documented in the final closure report. The estimated year of closure of the OB/OD units is 2100.

LANL fully intends to achieve clean closure of the OB/OD units by decontamination or removal of contaminated structures, equipment, or media. However, should clean closure not be achieved, a post-closure plan meeting the requirements of 20 NMAC 4.1.500 incorporating 40 CFR §264.603 will be developed for the OB/OD units and submitted to NMED for approval.

9.2 DESCRIPTION OF WASTE/ESTIMATE OF MAXIMUM WASTE CAPACITY

The following sections provide information on the waste types and quantities managed at the OB/OD thermal treatment units at TA-14, TA-15, TA-36, and TA-39.

9.2.1 TA-14

The thermal treatment units at TA-14 are located near Building 23 (TA-14-23) and are used to treat hazardous explosive waste by OB or OD. The OB thermal treatment unit has a maximum treatment capacity of 50 pounds of waste per burn; the OD thermal treatment unit has a maximum treatment capacity of 20 pounds of waste per detonation. LANL does not intend to reduce the areal extent of either unit during the active life of the units. Both units will eventually undergo closure; LANL does not anticipate leaving unclosed portions of these units. Both the design capacity and the areal extent are addressed in this section, as provided in the "RCRA Guidance Manual for Subpart G Closure and Post-Closure Care Standards and Subpart H Cost Estimating Requirements" (EPA, 1987). Hazardous waste that may be treated at the TA-14 OB/OD thermal treatment units includes waste generated during research and development activities and processing and recovery operations at various TAs throughout LANL. Information on the hazardous component of these wastes is provided in Section 3.0 of this Part B permit application.

9.2.2 TA-15

The thermal treatment unit located near TA-15-184 may be used to treat solid and liquid hazardous explosive waste by OD. The OD thermal treatment unit has a maximum treatment capacity of 500 pounds of waste per detonation. Waste that may be treated at the TA-15 OD thermal treatment unit includes waste generated during research and development activities and processing and recovery operations at various TAs throughout LANL. Information on the hazardous component of these wastes is provided in Section 3.0 of this Part B permit application.

9.2.3 TA-36

The thermal treatment unit located at TA-36 adjacent to TA-36-8 is used to treat solid and liquid hazardous explosive waste by OD. The OD thermal treatment unit has a maximum treatment capacity of 2,000 pounds of waste per detonation. Waste that may be treated at the TA-36 OD thermal treatment unit includes waste generated during research and development activities and processing and recovery operations at various TAs throughout LANL. Information on the hazardous component of these wastes is provided in Section 3.0 of this Part B permit application.

9.2.4 TA-39

The thermal treatment units located at TA-39 adjacent to TA-39-6 and TA-39-57 are used to treat hazardous explosive waste by OD. Each OD thermal treatment unit has a maximum treatment capacity of 1,000 pounds of waste per detonation. Hazardous waste that may be treated at the TA-39 OD thermal treatment units includes waste generated during research and development activities and processing and recovery operations at various TAs throughout LANL. Information on the hazardous component of these wastes is provided in Section 3.0 of this Part B permit application.

9.3 REMOVAL OF WASTE

Prior to the initiation of closure activities, wastes will be treated at or removed from the OB/OD thermal treatment unit to be closed. If removal is required, the wastes will be transported to an active, permitted treatment unit in accordance with the most current and approved applicable SOPs (e.g., DX-16:SOP 1.9). See Section 4.5 for procedures regarding removal of residues. Containers and packaged waste may be removed from the unit manually or with container-handling equipment, depending on the size, shape, and weight of the container. Flatbed trucks or trailers may be used for transport of the wastes. Appropriate shipping papers will accompany the wastes during transport. Remaining hazardous wastes will be moved to an approved on-site storage unit or to an off-site permitted treatment, storage, and disposal facility.

9.4 CLOSURE AND DECONTAMINATION PROCEDURES

To the extent possible, contaminated structures and equipment associated with a OB/OD thermal treatment unit to be closed will be decontaminated (if necessary) and removed. Structures, equipment, and media that cannot be decontaminated will be containerized and managed in compliance with appropriate regulations. Sampling conducted during closure and decontamination procedures will be done in accordance with quality assurance/quality control (QA/QC) procedures (see Section 9.1.8 of the LANL General Part B). Before proceeding with closure activities, the OB/OD thermal treatment unit and associated structures and equipment will be surveyed for radiological contamination, if necessary, and a thorough visual inspection will be conducted for unexploded explosive scrap. Personal protective equipment (PPE) and monitoring requirements will be determined by LANL's Health Physics Operations (ESH-1) and Industrial Hygiene and Safety (ESH-5) Groups, and groups within the Dynamic Experimentation (DX) Division (for explosives handling) following the initial field inspection. Radiation and chemical monitoring will occur throughout closure activities, as appropriate. If any contamination is found, the contaminated material will be decontaminated (if possible) or containerized and taken to an approved storage location at LANL appropriate for the waste type.

Personnel involved in closure activities will wear appropriate PPE, specified by ESH-1, ESH-5, and DX, and will follow good hygiene practices to protect themselves from exposure to hazardous waste. The level of PPE required will depend upon the levels of radiological and/or chemical contamination detected, if any. If ESH-1, ESH-5, and DX surveys do not indicate detectable contamination levels, minimum PPE requirements will consist of coveralls, steel-toed footwear, and safety glasses or face shields. If an overhead danger is present, a hard hat will be worn. Workers involved in closure activities will be required to have training and medical monitoring. Contaminated PPE will either be decontaminated or managed in compliance with appropriate regulations.

Before decontamination activities begin, two samples of clean water and detergent (wash water) solution squeezed from mops and/or sponges prior to use will be collected for analysis of the parameters listed in Table 9-2, as appropriate, to provide a baseline for decontamination verification. Structures and equipment at the OB/OD thermal treatment unit requiring decontamination will be wiped down with wash water solution. Mops and/or sponges will be used to minimize the amount of liquid waste generated as a result of decontamination activities. The washdown solution will be contained using portable berms and/or other containment structures and equipment, as appropriate. Wash water generated from equipment decontamination activities will be contained by the portable berms and/or containment structures.

Used wash water will be collected and transferred to appropriate containers and sampled for the parameters listed in Table 9-2, as appropriate. The wash cycles will continue until the structures and equipment at the OB/OD thermal treatment unit have been cleaned to established levels (see Section 9.6). The used wash water will be managed appropriately in accordance with LANL policy.

Prior to the initiation of closure activities, background soil samples will be collected in the vicinity of the OB/OD thermal treatment unit and analyzed for the parameters listed in Table 9-2, as appropriate. After the structures and equipment have been decontaminated (if possible), removed, and managed, as appropriate, a statistically representative number of soil samples will be collected in the vicinity of the OB/OD thermal treatment unit and analyzed for the parameters listed in Table 9-2, as appropriate. Samples will be collected to a depth of 6 inches and will be spaced to ensure that samples are representative of the entire area covered by the OB/OD thermal treatment unit. Soil sampling will be conducted by the methods described in Section 9.2 of the LANL General Part B. Samples will be analyzed for the parameters listed in Table 9-2, as appropriate. If contamination is found in any of the soil samples as a result of treatment activities, the contaminated soil will be removed to statistically significant levels based on concentrations in the background soil samples.

9.5 DECONTAMINATION EQUIPMENT

Prior to use, reusable decontamination equipment will be rinsed with distilled water. Decontamination equipment rinsate blanks will be collected and analyzed in accordance with QA/QC procedures (see Section 9.1.8 of the LANL General Part B). Reusable protective clothing, tools, and equipment used during closure activities will be scraped as necessary to remove any residue and cleaned with wash water. Residue and disposable or reusable equipment that cannot be decontaminated will be containerized and managed as appropriate for the waste type. Used wash water will be collected and analyzed for the parameters listed in Table 9-2 and managed appropriately in accordance with LANL policy.

9.6 DECONTAMINATION VERIFICATION

Sufficient sampling and analysis will be required to demonstrate that hazardous waste or hazardous waste residue is not present at the site after closure. Two samples of clean wash water squeezed from mops and/or sponges prior to use will be collected before initial washdowns of the various equipment and structures associated with the OB/OD thermal treatment unit. The samples will be analyzed for the applicable parameters listed in Table 9-2 to provide baseline data for decontamination verification. Analytical procedures will conform to methods found in the U.S. Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," (SW-846) (EPA, 1986a). Used wash water will also be analyzed for the applicable parameters listed in Table 9-2. Used wash water will be considered contaminated if it shows a significant increase (i.e., determined using statistical methods defined in SW-846) in the analytical parameters over the clean wash water. If subsequent washdowns are deemed necessary, an additional sample of clean wash water squeezed from mops and/or sponges prior to use will be taken for each additional washdown event.

Successful decontamination meets one of the following criteria:

- No detectable hazardous waste or hazardous constituents from treatment activities are found in the final sample.
- Detectable hazardous waste or hazardous constituents from treatment activities in the final sample are removed to statistically significant levels based on baseline concentrations in the clean wash water or established background soil data.
- Detectable hazardous waste or hazardous constituents from treatment activities in the final sample are at or below levels agreed upon with the New Mexico Environment Department.

If detectable hazardous waste or hazardous constituent concentrations from treatment activities do not significantly decrease after several washdowns, LANL will amend this closure plan to address appropriate closure procedures or post-closure care requirements pursuant to 20 NMAC, 4.1, Subpart V, 264.117 through 264.120, revised November 1, 1995.

Table 9-1

Closure Schedule for the Open Burning/Open Detonation Units

Activity	Maximum Time Required[a]
Let contract request for proposals	-90 Days
Notify the New Mexico Environment Department (NMED)	-45 Days
Receive proposals	-30 Days
Select contractor and award contract	-10 Days
Collect background samples (if appropriate)	-5 Days
Final treatment of waste	Day 0
Begin closure activities (perform washdown of structures and/or equipment)	Day 10
Perform initial sampling of the waste management unit	Day 15
Analyze samples	Day 45
Perform additional washdown (if necessary)	Day 50
Perform additional sampling (if necessary)	Day 60
Analyze samples (if necessary)	Day 90
Perform final cleanup (e.g., removal of decontaminated equipment and decontamination wastes)	Day 120
Verify decontamination	Day 150
Submit final report to NMED	Day 180

[a] The schedule above indicates calendar days from the beginning by which activities will be completed. Some activities may be conducted simultaneously and/or may not require the maximum time listed.

Table 9-2

Analytical Parameters and Test Methods for the Open Burning/Open Detonation Units

Parameter	Test Method	Reference[a]
Ignitability	Pensky-Martens closed-cup method	(L, S) SW1010 (L, S) ASTM D93-80
Reactivity	Test method to determine hydrogen cyanide (HCN) released from waste	(L,S) HCN Test Method SW, Section 7.3
	Test method to determine hydrogen sulfide (H_2S) released from waste	(L, S) H_2S Test Method, SW, Section 7.3
Corrosivity	Electrometric (pH of aqueous solution)	(L) SW9040B
Toxicity characteristic	Toxicity characteristic leaching procedure (TCLP) extraction	(S) SW1311
Metals	Graphite furnace atomic absorption (AA) spectroscopy, gaseous hydride AA, or direct aspiration AA	
Arsenic		(L,S) SW7060A, SW7061A
Barium		(L,S) SW7080A, SW7081
Cadmium		(L,S) SW7130, SW7131A
Chromium		(L,S) SW7190, SW7191
Lead		(L,S) SW7420, SW7421
Selenium		(L,S) SW7740, SW7741A
Silver		(L,S) SW7760A, SW7761
Mercury	Manual cold-vapor technique	(L) SW7470A, (S) SW7471A
Volatile organics	Gas chromatography/mass spectrometry (GC/MS)	(L,S) SW8240B
	GC/MS capillary column technique	(L,S) SW8260A
Semivolatile organics	GC/MS	(L,S) SW8250A
	GC/MS capillary column technique	(L,S) SW8270B
Organochlorine pesticides	TCLP extraction and GC	(L,S) SW8080A

Refer to footnotes at end of table.

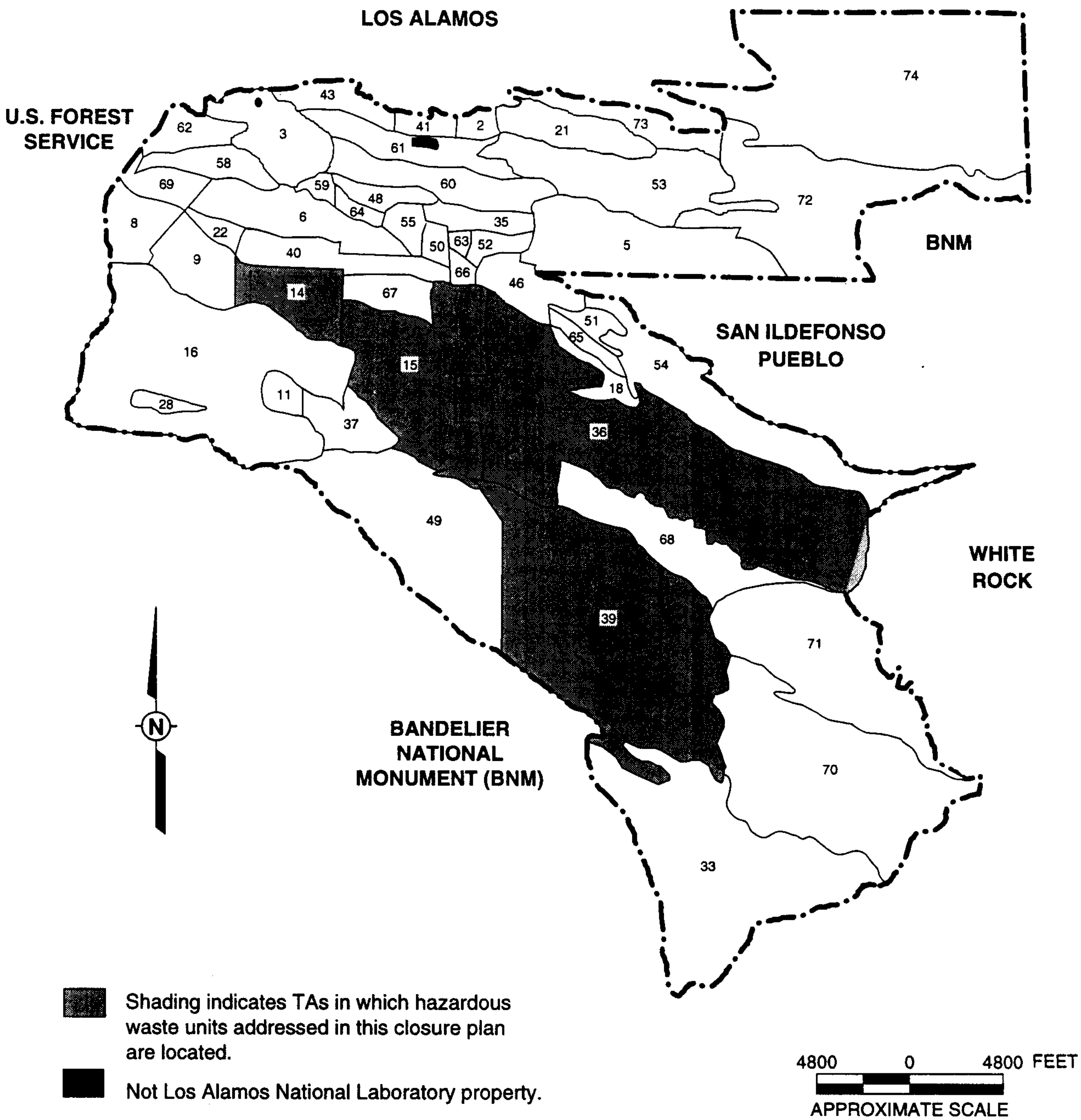
Table 9-2 (Continued)

Analytical Parameters and Test Methods for the Open Burning/Open DetonationUnits

Parameter	Test Method	Reference[a]
Chlorinated herbicides		(L,S) SW8150B
Total metals[b]	Acid digestion	(L) SW3010A, (S) SW3050A
	Inductively coupled plasma emission spectroscopy	(L,S) SW6010A
Arsenic		(L,S) SW6010A
Barium		(L,S) SW6010A
Beryllium		(L,S) SW6010A
Cadmium		(L,S) SW6010A
Chromium		(L,S) SW6010A
Lead		(L,S) SW6010A
Nickel		(L,S) SW6010A
Selenium		(L,S) SW6010A
Silver		(L,S) SW6010A
Thallium		(L,S) SW6010A
Zinc		(L,S) SW6010A
Mercury	Manual cold-vapor technique	(L) SW7470A, (S) SW7471A
Free liquids	Paint Filter Liquids Test	(S) SW9095

[a] "ASTM" refers to American Society for Testing and Materials standards.
"SW" refers to U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*.
(L) refers to liquid waste.
(S) refers to solid waste.

[b] See also atomic absorption methods.



Note: TA-57, the Fenton Hill Geothermal Site, is not shown on this figure.

Modified from Los Alamos National Laboratory, 1994, "Environmental Surveillance at Los Alamos During 1992," LA-12764-ENV, Los Alamos National Laboratory, Los Alamos, New Mexico.

Figure 9-1
Technical Areas (TA) Where Open Burning/Open Detonation Units Addressed in the Closure Plan Are Located

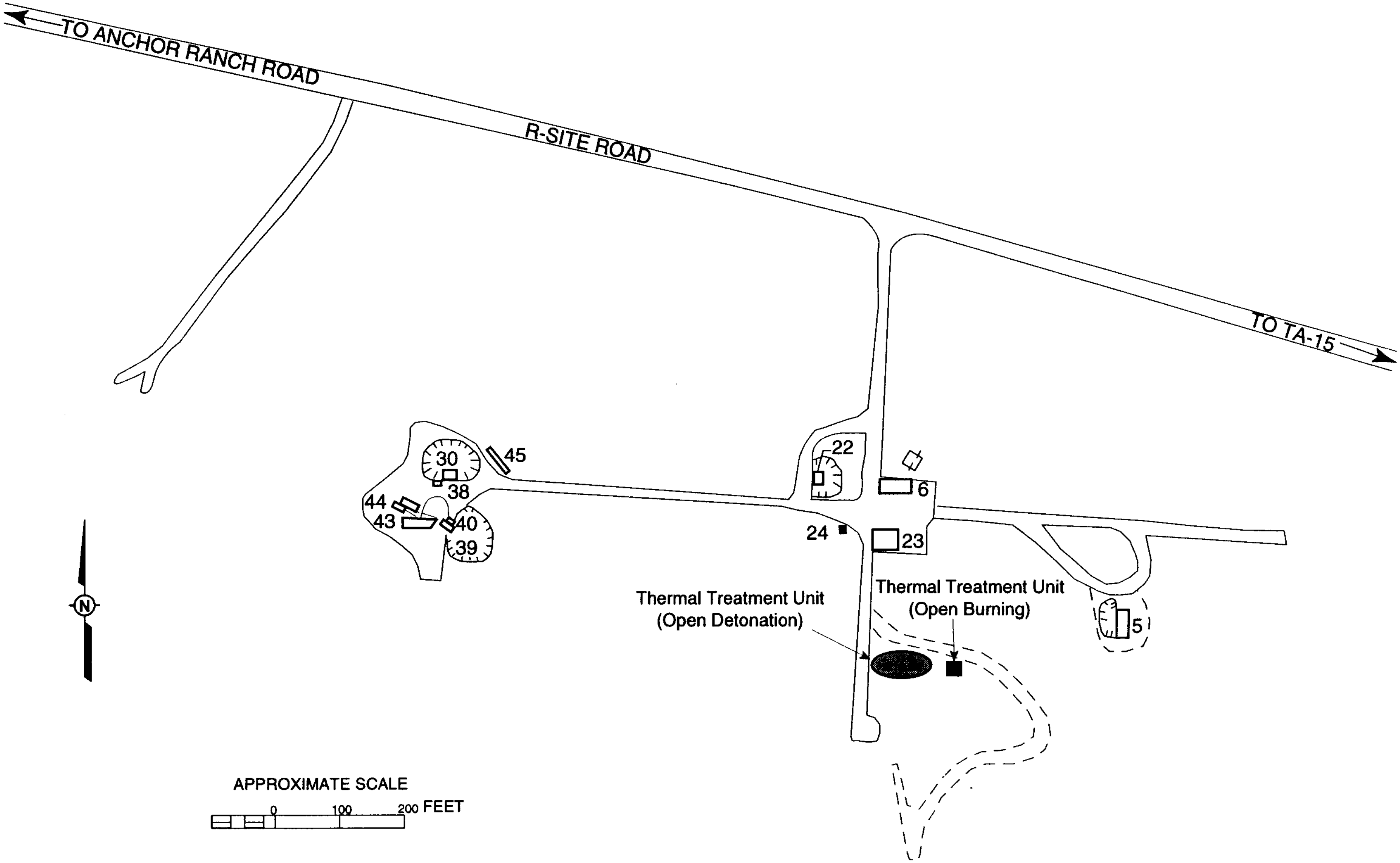


Figure 9-2
Location Map Showing the Thermal Treatment Units near Technical Area (TA) 14, Building 23

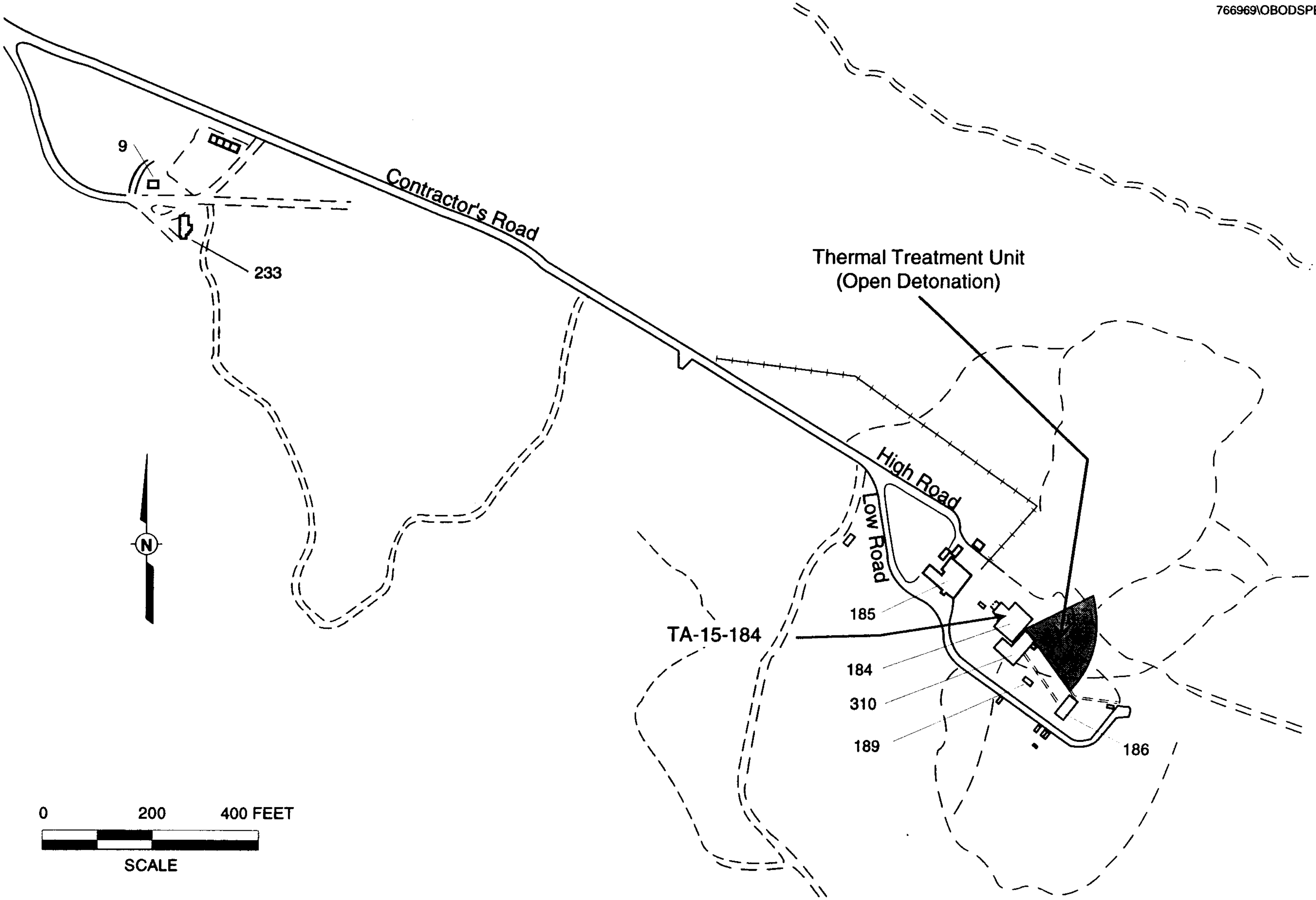


Figure 9-3
Location Map Showing the Thermal Treatment Unit near Technical Area (TA) 15, Building 184

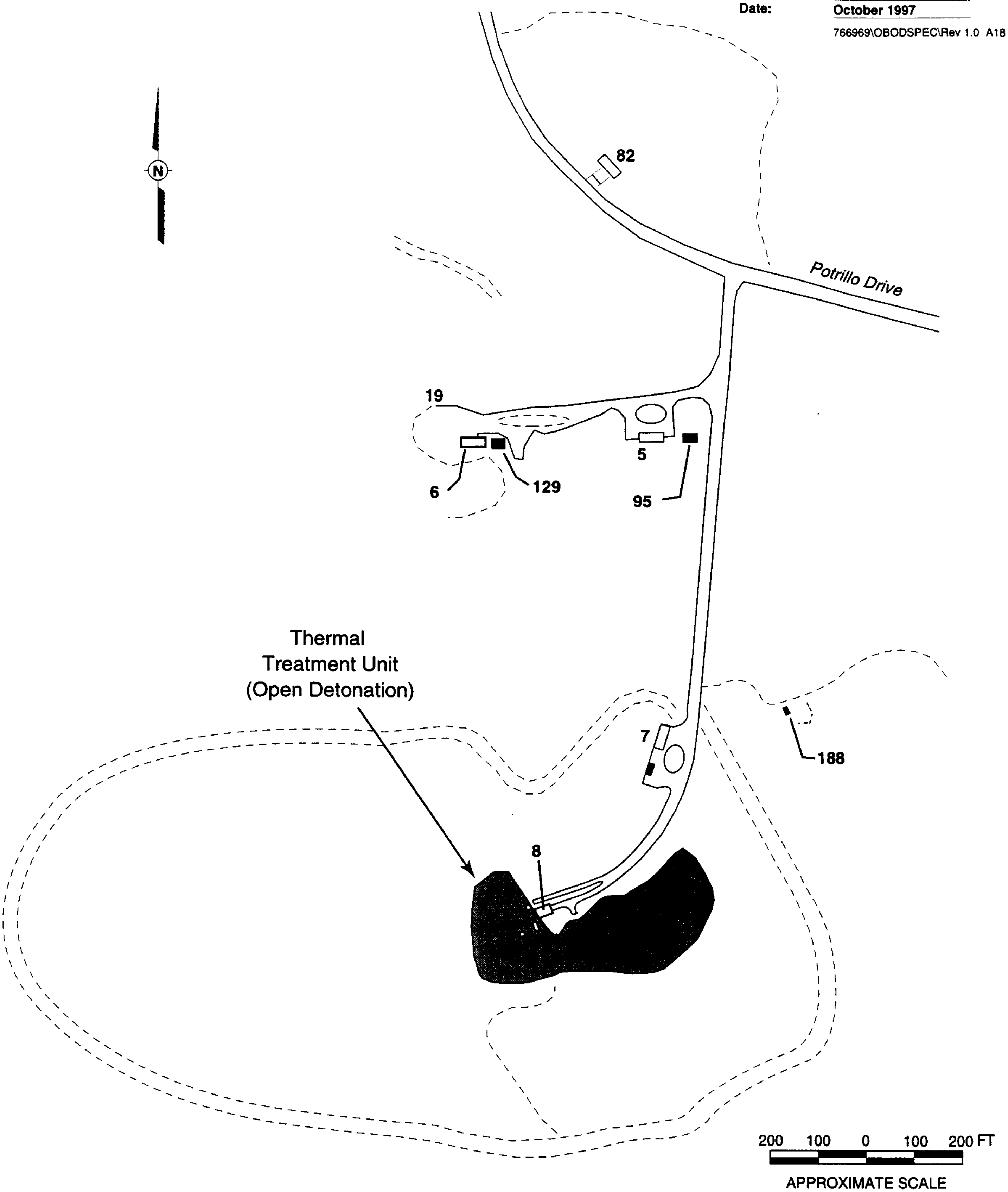


Figure 9-4
Location Map Showing the Thermal Treatment Unit near Technical Area 36, Building 8

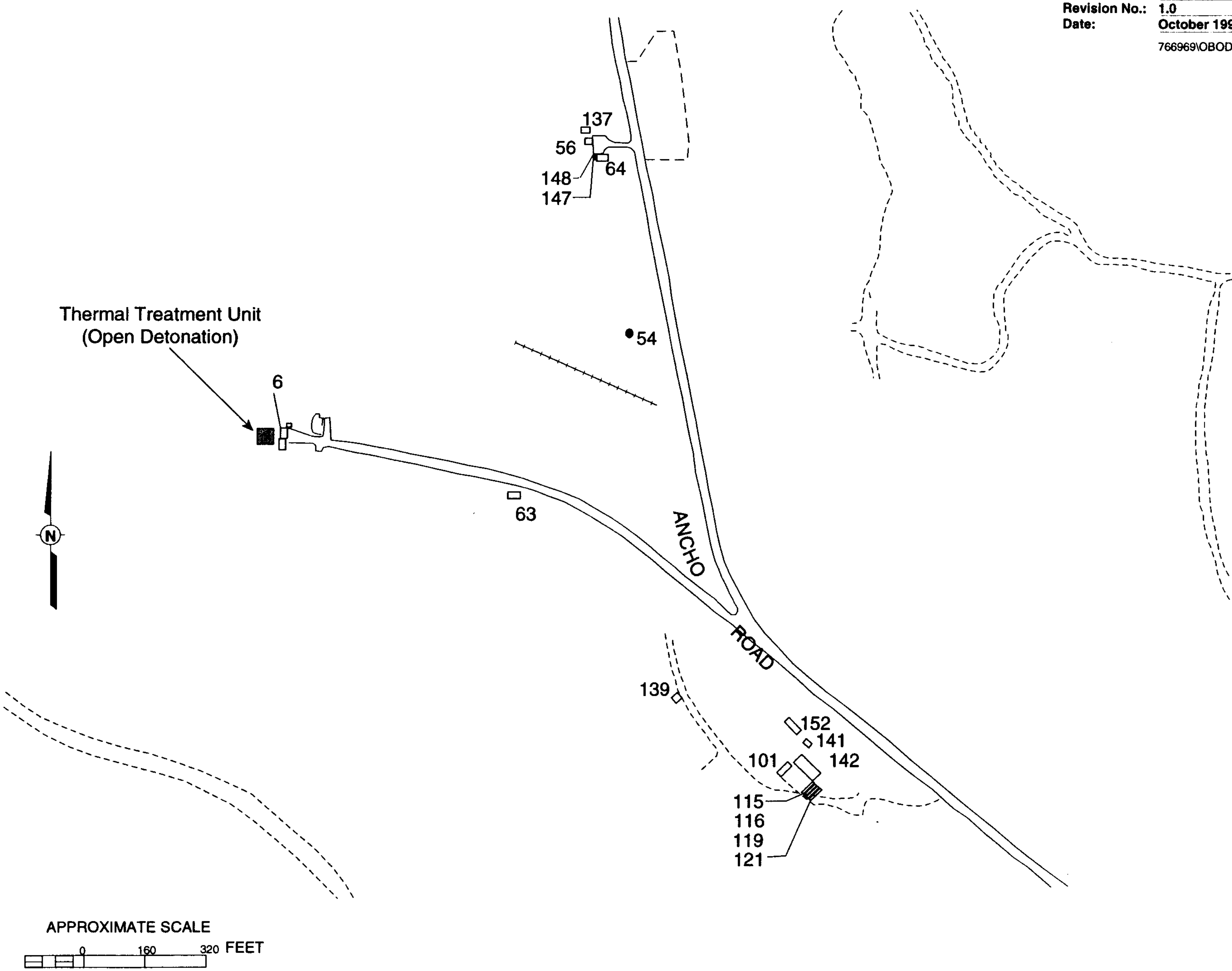


Figure 9-5
Location Map Showing the Thermal Treatment Unit near Technical Area 39, Building 6

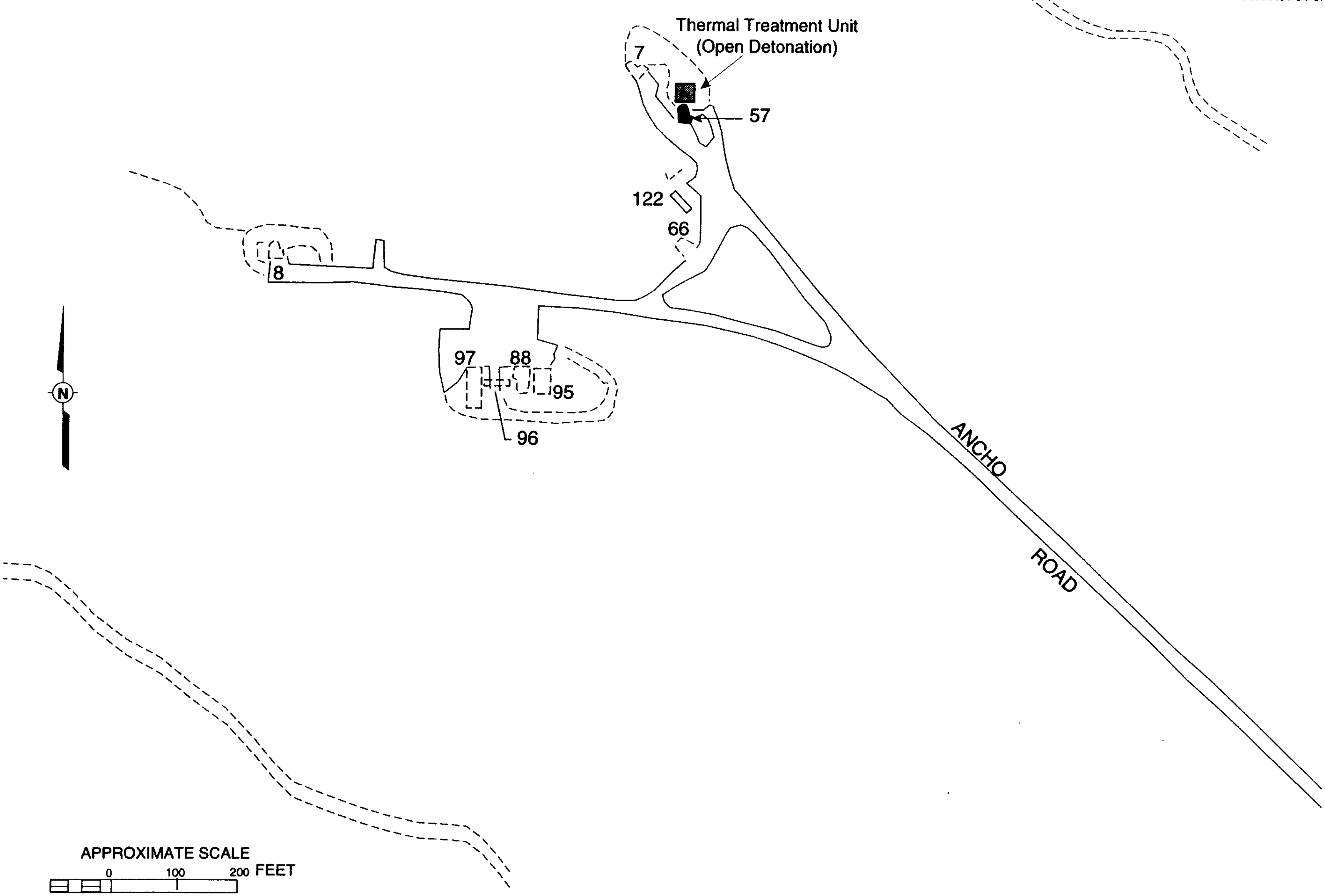


Figure 9-6
Location Map Showing the Thermal Treatment Unit near Technical Area 39, Building 57

10.0 CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS

This section describes selected solid waste management units (SWMU) that have been identified in Technical Area (TA) 14, TA-15, TA-36, and TA-39 at Los Alamos National Laboratory (LANL). Because these TAs encompass large areas and contain a large number of or widely distributed SWMUs, this section addresses only those SWMUs that may reasonably be expected to potentially impact the units included in this Part B permit application. Information on the remaining SWMUs in these TAs is contained in Revision 1.0 of LANL's "Solid Waste Management Units Report" (LANL, 1990), hereinafter referred to as the 1990 SWMU Report, and in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) work plans for the various operable units encompassing these TAs (see Section 10.1). The information in this section is being submitted in response to regulatory requirements in the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1), Subpart IX, 270.14(d), revised November 1, 1995.

LANL uses the definition of a SWMU presented in "Module VIII: Special Conditions Pursuant to the 1984 Hazardous and Solid Waste Amendments to RCRA for Los Alamos National Laboratory, EPA I.D. NM0890010515" (U.S. Environmental Protection Agency [EPA], 1994b), hereinafter referred to as Module VIII. This definition states that SWMUs are "any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at or around a facility at which solid wastes have been routinely and systematically released."

10.1 SWMU DESCRIPTIONS

Several types of SWMUs are present in TA-14, TA-15, TA-36, and TA-39. These SWMUs include those identified for corrective actions in Module VIII, as modified following a Class III permit modification effective May 19, 1994; SWMUs that are active hazardous waste management units; and SWMUs identified in the 1990 SWMU Report. Descriptions of the SWMUs are presented in the following sections. These descriptions were compiled from the "RFI Work Plan for Operable Unit 1085" (LANL, 1994a); from the "RFI Work Plan for Operable Unit 1086" (LANL, 1993a); from the "RFI Work Plan for Operable Unit 1130" (LANL, 1993b); from the "RFI Work Plan for Operable Unit 1132" (LANL, 1993c); and from the 1990 SWMU Report.

Brief unit and waste descriptions are also provided in Table 10-1. Figures 10-1 through 10-4 show the locations of the selected SWMUs at TA-14, TA-15, TA-36, and TA-39, respectively.

10.1.1 TA-14 SWMUs

SWMUs at TA-14 and in the vicinity of the TA-14 open burning/open detonation (OB/OD) thermal treatment units include pullboxes, firing sites, a burning area, storage areas, a burn cage, a sump, and a septic system.

10.1.1.1 Pullboxes

SWMU Nos. 14-001(a-e) are small structures referred to as pullboxes or pits. Each pullbox measures 26- by 32- by 32-inches and contains a capacitor discharge unit used to initiate a detonation (LANL, 1994a). SWMU Nos. 14-001(a-e) are associated with structures TA-14-25, TA-14-26, TA-14-27, TA-14-28, and TA-14-29, respectively. Waste materials potentially present in or near the pullboxes include various types of explosives, lead, uranium, strontium-90, and beryllium (LANL, 1990).

10.1.1.2 Firing Sites

A firing site [SWMU No. 14-001(g)] is located approximately 75 feet south of structure TA-14-23 (i.e., the control building) at TA-14. The firing area was constructed in 1964 and consists of a three-sided blast shield and a concrete pad. The concrete pad measures six feet square by two feet thick and is overlain with a neoprene shock pad and a 4.5-inch-thick steel plate. Several inches of sand cover the entire pad assembly (LANL, 1994a). Waste materials currently managed or potentially present at this SWMU include various types of explosives, lead, beryllium, strontium-90, and uranium (LANL, 1990).

SWMU No. 14-002(c) is a former firing site control building (TA-14-5) constructed in 1944. The control building measures 11- by 18- by 10-feet; the site originally had a concrete bunker and 0.5-inch steel plate (LANL, 1994a). Two firing pads [SWMU Nos. 14-002(d) and 14-002(e)] are associated with TA-14-5 and are located south of the building, approximately 35 feet apart. Explosives testing on each of the pads was controlled from TA-14-5. Explosives testing at the site ceased in 1961 and the building was converted to a storage building. From 1980 until 1985, the area was the site of slow combustion experiments conducted in a 5-foot-diameter metal sphere (LANL, 1994a). The site has not been used since 1985. Potential contaminants may include various types of explosives as well as lead, uranium, and beryllium (LANL, 1990). SWMU Nos. 14-002(c-e) are identified in Module VIII.

10.1.1.3 Burning Area

An inactive trash burning area [SWMU No. 14-003] is located approximately 600 feet east of TA-14-23 (LANL, 1994a). This SWMU consists of an open dirt area surrounded by a 4.5-foot-high, horseshoe-shaped berm. The area was used in the 1950s and 1960s to burn explosives-contaminated materials (LANL, 1990; LANL, 1994a). Soil samples collected from the area indicate the presence of various metals, including barium and beryllium, as well as cesium-137 (LANL, 1990). SWMU No. 14-003 is identified in Module VIII.

10.1.1.4 Storage Areas

Satellite accumulation areas are or were located at TA-14-22, TA-14-23, and TA-14-35 and have been designated as SWMU Nos. 14-004(a), 14-004(b), and 14-004(c), respectively. These areas are or were used to store scrap explosives and explosives-contaminated items. SWMU No. 14-004(b) is identified in Module VIII. Currently, satellite accumulation areas at TA-14-23 are located in Room 104 and outside along the west wall of the building.

10.1.1.5 Burn Cage

A burn cage is located near Firing Mound 3 at TA-14 and is identified as SWMU No. 14-005 in Module VIII. The unit consists of an approximately 2.5-foot-wide, semicircular piece of 0.25-inch-thick steel with a wire mesh door and wire mesh top and bottom. The burn cage is approximately 3 feet tall and is situated on a steel burn tray. The burn cage has a capacity of approximately 3 cubic feet and is used to burn paper and small laboratory equipment contaminated with explosives (LANL, 1994a). This OB thermal treatment unit currently operates under the requirements of 20 NMAC 4.1, Subpart VI, revised November 1, 1995, and is one of the units for which this Part B permit application is being submitted.

10.1.1.6 Sump

A sump, an associated drainline, and an unpermitted outfall area serving TA-14-23 have been designated as SWMU No. 14-006 in Module VIII. The sump is constructed of steel and concrete and measures approximately 4.5 feet wide, 8.3 feet long, and 4.8 feet deep. The sump, which is now plugged, was formerly used to filter small pieces of explosives from liquid discharged through a drain in TA-14-23. The drainline extends approximately 20 feet from the building and drains down an embankment. Currently, the only discharge to the outfall is rainwater. The sump, filter, and drain may be contaminated with explosives (LANL, 1994a).

10.1.1.7 Septic System

A septic system is located in the central part of TA-14 and formerly served TA-14-6. The septic tank (TA-14-19) was installed in October 1944 and is constructed of reinforced concrete. It measures 4- by 7- by 6-feet and has a capacity of 640 gallons. The septic tank was connected to an overflow drainline that extended 130 feet from the building and drained into a ditch. In 1988, a leach field was installed replacing the drainline. Waste materials suspected or known to have been managed at the unit include photographic darkroom chemicals (e.g., organics, silver, cyanide) and sanitary effluents (LANL, 1994a). The septic tank was disconnected from TA-14-6 in 1992 and remains inactive. The unit is identified as SWMU No. 14-007 in Module VIII.

10.1.2 TA-15 SWMUs

SWMUs at TA-15 and in the vicinity of the TA-15 OD thermal treatment unit include firing sites, septic systems, underground storage tanks, and drainlines and outfalls.

10.1.2.1 Firing Sites

An active firing site is located near TA-15-184. The firing site consists of a chamber (TA-15-184), related equipment in a building complex, and a firing pad. The firing pad is comprised of a 12- by 24- by 0.5-foot steel pad and two bunkers that are used to temporarily stage scrap explosives awaiting detonation. This OD thermal treatment unit operates under the requirements of 20 NMAC 4.1, Subpart VI, revised November 1, 1995, for treatment of hazardous explosive waste and is one of the units for which this Part B permit application is being submitted. Potential hazardous constituents at the TA-15-184 firing site include barium, lead, mercury, depleted uranium, thorium, beryllium, and gallium. The firing pad and chamber are designated as SWMU Nos. 15-003 and 15-006(a), respectively, in the 1990 SWMU Report and in Module VIII.

Firing Site H [SWMU No. 15-004(h)] is an inactive firing site located in TA-15. In operation from 1948 until around 1953, Firing Site H was typically used for large-scale explosives tests.

Potential constituents at this SWMU include uranium-238, beryllium, lead, and residual explosive material (LANL, 1993a).

10.1.2.2 Septic Systems

A septic system (TA-15-205), comprised of a 610-gallon septic tank and associated plumbing, serves TA-15-184. The unit is identified in the 1990 SWMU Report and in Module VIII as SWMU No. 15-009(g). The septic system manages sanitary waste but may have also received mixed waste.

A drain connected to a sanitary sewer system serves the camera firing point at TA-15-92. This drain is identified in the 1990 SWMU Report and in Module VIII as SWMU No. 15-010(c). The unit was originally described as a septic system; however, more recent information suggests that the unit is actually a storm drain. The materials managed at this unit are unknown.

10.1.2.3 Underground Storage Tanks

A 1,036-gallon underground storage tank (TA-15-192) was located at TA-15. The tank, which contained propane, was relocated to TA-49 in December 1959. It is not known whether the tank leaked while located in TA-15 (LANL, 1993a). In the 1990 SWMU Report, the tank is designated as SWMU No. 15-013(a).

An additional underground storage tank (TA-15-287) was formerly located just north of TA-15-184. The 15,000-gallon tank was used to store mineral oil; the tank was removed in October 1992. Soil sampling conducted after the tank's removal indicated the presence of total petroleum hydrocarbons at concentrations below 15 parts per million (LANL, 1993a). In the 1990 SWMU Report and in Module VIII, the unit is designated as SWMU No. 15-013(b).

10.1.2.4 Drainlines and Outfalls

A drainline that serves a cooling tower (TA-15-202) is identified as SWMU No. 15-014(l) in the 1990 SWMU Report and in Module VIII. The drainline, located at the base of the cooling tower, drains cooling water into Water Canyon via a permitted outfall. A second drainline [SWMU No. 15-014(d)] is located south of TA-15-185. Hazardous constituents are not anticipated in either of these drainlines (LANL, 1993a).

An outfall [SWMU No. 15-014(e)] is located approximately 20 feet south and 6 feet east of the southeast corner of TA-15-184. The unit is connected via a 6-inch vitrified clay pipe to basement floor drains in TA-15-184 and drains through a 12-inch corrugated metal pipe into Water Canyon. Hazardous constituents are not expected at this outfall (LANL, 1993a).

10.1.3 TA-36 SWMUs

SWMUs at TA-36 and in the vicinity of the TA-36 OD thermal treatment unit include firing sites, storage areas, and waste storage containers.

10.1.3.1 Firing Sites

Two firing sites have been designated as SWMUs at TA-36. Constructed in 1950, the Meenie Firing Site is located at the headwaters of Fence Canyon. The Meenie Site is comprised of a magazine building, a control bunker, and an impact area and has been used for extensive gun testing (LANL, 1993b). Potential constituents at the Meenie Site may include depleted uranium, various heavy metals, plastics, explosives, and various other chemicals. This active firing site is identified in the 1990 SWMU Report as SWMU No. 36-004(b).

An additional firing site is also located at TA-36-8. The TA-36-8 firing site [SWMU No. 36-004(c)] was constructed in 1950 and is located approximately 800 feet south of the Meenie Site. This active firing site has been used for armor-piercing experiments involving the use of various metal penetrators (LANL, 1993b). The site may also operate under the requirements of 20 NMAC 4.1, Subpart VI, revised November 1, 1995, for OD thermal treatment of hazardous waste, scrap explosives, and unstable gas cylinders and is one of the units for which this Part B permit application is being submitted. Potential contaminants at the TA-36-8 site are the same as those described above for the Meenie Site.

10.1.3.2 Storage Areas

A surface storage area, known as the Boneyard, is located near TA-36-7. The Boneyard is an undeveloped area measuring approximately 500- by 300-feet that was used from the late 1970s until the late 1980s for storage of large waste items that had been used in explosives testing. Waste items stored at the Boneyard included metal drums, cans, cylinders, and scrap metals such as lead sheets, copper, uranium-contaminated steel, and iron. The Boneyard was extensively cleaned up in response to a 1986 field survey and is now used to store nonwaste items (LANL, 1993b). It is identified in the 1990 SWMU Report and in Module VIII as SWMU No. 36-005.

10.1.3.3 Waste Storage Containers

Active satellite waste storage containers at TA-36 are located inside Buildings 5, 7, and 8 and at a firing site near TA-36-8. The units are designated as SWMU Nos. 36-007(b), 36-007(c), 36-007(d), and 36-007(f), respectively, in the 1990 SWMU Report. Each waste storage container consists of a small corrugated cardboard box lined with plastic. The boxes are used to store small quantities (less than 5 gallons) of explosives-contaminated solid waste items until the waste is treated (LANL, 1993b).

10.1.4 TA-39 SWMUs

SWMUs at TA-39 and in the vicinity of the TA-39 OD thermal treatment units include storage areas and firing sites.

10.1.4.1 Storage Areas

A storage area [SWMU No. 39-002(b)] is located on a concrete pad outside of TA-39-6. The area measures approximately 5 feet square and has been used since 1953 to store small quantities of contaminated paper materials. Chemical contaminants include waste solvents, such as ethanol, acetone, trichloroethane, and copper sulfate; transformer oil; vacuum grease; and photographic wastes. Waste materials are not currently stored in this area and there is no evidence of spills or leaks (LANL, 1993c).

SWMU No. 39-002(d) is a storage area located outside of TA-39-57. The area consists of a gravel pad that has been used since the 1980s to store the same type of wastes described above (LANL, 1993c). Spills or leaks in the area have not been observed or documented. Waste materials are not currently stored in this area.

A storage area [SWMU No. 39-002(f)] is associated with TA-39-88. The storage area, which is located on an asphalt driveway adjacent to the building, has been used since the 1980s to store small volumes of waste solvents, such as ethanol, acetone, trichloroethane, and copper sulfate; transformer oil; vacuum grease; and photographic wastes. Spills or leaks in the area have not been observed or documented. Waste materials are not currently stored in this area (LANL, 1993c).

10.1.4.2 Firing Sites

TA-39 contains one inactive and four active firing sites that have been designated as SWMU Nos. 39-004(a-e) in Module VIII and are associated with structures TA-39-7, TA-39-8, TA-39-6, TA-39-57, and TA-39-88, respectively. The firing sites associated with Buildings 7, 8, and 6 were established in 1953; the firing site associated with Building 57 was established in 1958; and the firing site associated with Building 88 was established in 1978. With the exception of SWMU No. 39-004(b), all of the firing sites are active. Operations at SWMU No. 39-004(b) were discontinued in 1980 for safety reasons (LANL, 1993c). Each of the active firing sites consists of an open, sand-covered area surrounded by steep canyon walls which serve to attenuate most of the blast. The pads range in size from approximately 500 to 7,700 square feet. Waste materials managed at the sites include uranium, mercury, lead, beryllium, and in the past, dielectric oil containing polychlorinated biphenyls (LANL, 1990). Residual explosives are also likely on and around the firing pads.

Two of the firing sites [SWMU Nos. 39-004(c) and 39-004(d)] are active hazardous waste management units operating under the requirements of 20 NMAC 4.1, Subpart VI, revised November 1, 1995, and are two of the OD thermal treatment units for which this Part B permit application is being submitted.

10.2 RELEASES

Some of the SWMUs listed in Table 10-1 are known or are suspected to have released hazardous waste or hazardous constituents. According to the 1990 SWMU Report, the firing sites at TA-14 [SWMU Nos. 14-001(f) and (g)] have resulted in the release of explosives to the surrounding areas. Uranium has also been detected in these areas (LANL, 1990).

The decommissioned firing site at TA-14 [SWMU Nos. 14-002(c-e)] is suspected to have released hazardous (e.g., explosives, metals) and radioactive materials to the surrounding area although the extent of contamination has not been adequately determined (LANL, 1994a; LANL, 1990).

Soil samples collected from the trash burning area [SWMU No. 14-003] indicate the presence of various metals, including barium and beryllium, as well as cesium-137 (LANL, 1990). The area is also suspected of being contaminated with explosives residues (LANL, 1994a). It is unknown whether contaminants have migrated beyond the area (LANL, 1990).

Samples of ash collected from the burn cage at TA-14 [SWMU No. 14-005] revealed the presence of heavy metals, polynuclear aromatic hydrocarbons, and radionuclides (e.g., cesium-137). It is not known whether the area around the burn cage is contaminated (LANL, 1990).

Soil in the area of the sump, drainline, and outfall at TA-14-23 [SWMU No. 14-006] is suspected to have been contaminated with explosives, although the extent of contamination has not been ascertained.

Barium is known to have been released from SWMU No. 15-003, although the extent of contamination is not known. Analyses of soil samples collected from various locations within the hazard radius of Firing Site H [SWMU No. 15-004(h)] indicate the presence of barium, beryllium, lead, and total uranium above instrument detection limits (LANL, 1993a).

Explosives testing conducted at TA-15-184 [SWMU Nos. 15-003 and 15-006(a)] has resulted in the deposition of explosives residues in the soil surrounding the facility (LANL, 1993a). Two firing sites at TA-36 [SWMU Nos. 36-004(b) and (c)] are also reasonably expected to have released explosives residues, although the nature and extent of contamination, if any, has not been adequately determined.

Samples collected from the Boneyard [SWMU No. 36-005] indicate the presence of various metals (e.g., chromium, lead, silver, and copper) and radioactive isotopes (e.g., thorium-232, uranium isotopes, potassium-40, and cesium-137). Explosives residues and shrapnel from the two firing sites at TA-36 are also present at the Boneyard (LANL, 1993b).

Explosives testing conducted at the firing sites at TA-39 [SWMU Nos. 39-004(a-e)] has most likely resulted in the deposition of explosives residues and heavy metals (e.g., uranium, mercury, lead, beryllium) in the soil surrounding each of the firing areas. The nature and extent of contamination, if any, has not been adequately determined.

10.2.1 Characterization of Releases

Potential releases from SWMUs, if any, are described in the 1990 SWMU Report and in the various RFI Work Plans. The descriptions include the material released and the nature of the release. However, because of the nature of the releases, the exact volume released is not known. The timing of the releases can only be estimated by the period of operation and sampling events.

10.2.2 Corrective Actions

Pursuant to 20 NMAC 4.1, Subpart V, 264.101(a), revised November 1, 1995, corrective actions are required only for releases of hazardous waste or hazardous constituents. The SWMUs will be investigated and remediated, as necessary and with EPA and New Mexico Environment Department approval, during LANL Environmental Restoration Project corrective action activities. Corrective action at the any of the TAs discussed in this section will generally follow the RFI/Corrective Measures Study process.

3867-H

Figure 10-1:
Solid Waste Management Units (SWMU) in the Vicinity of the Thermal Treatment Units near Technical Area (TA) 14, Building 23

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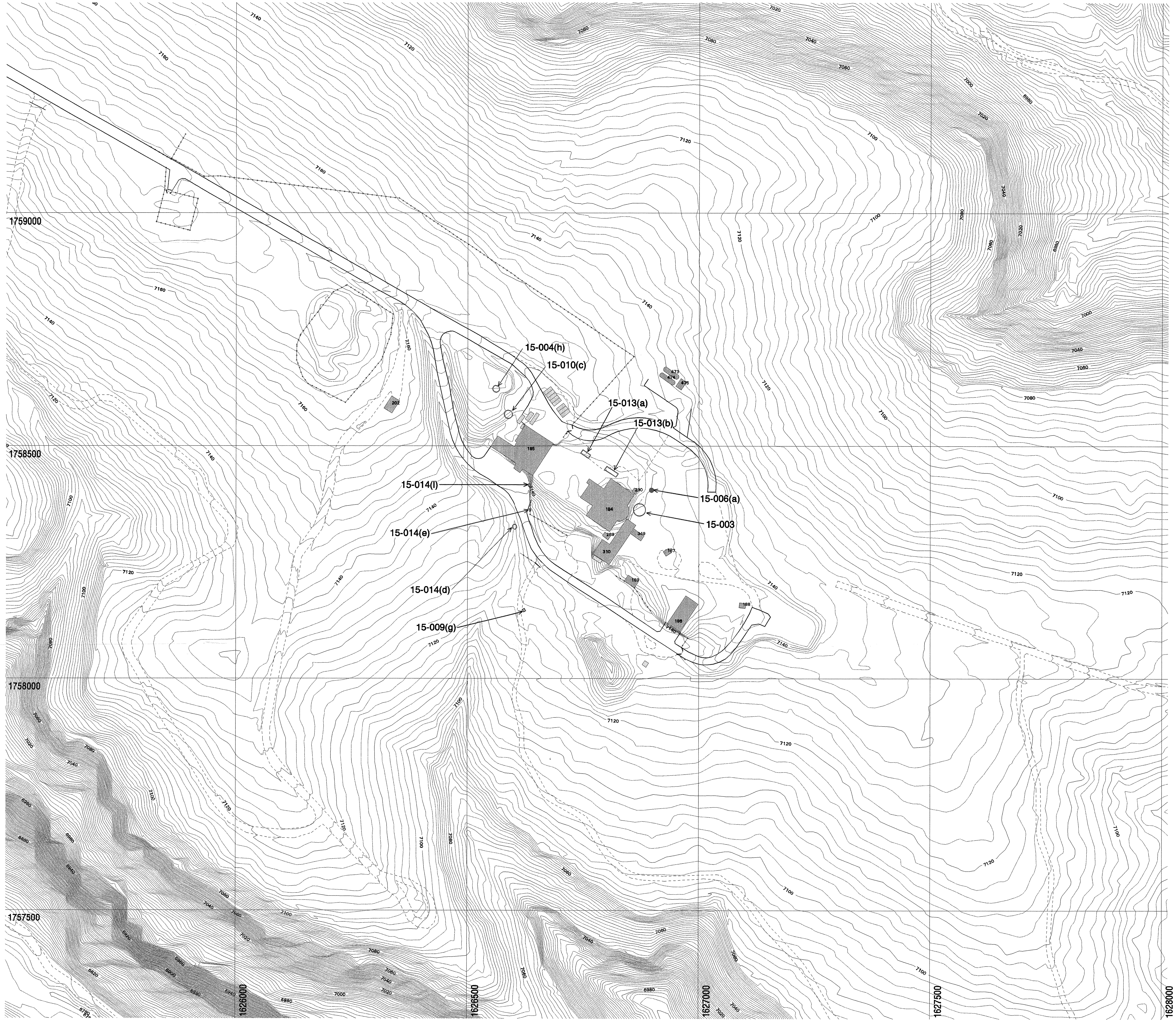
FIMAD Plot ID: G104972



LEGEND

- Contour, 10 ft
- Contour, 2 ft
- Fence, Industrial
- Road, Dirt
- Road, Paved
- Road/Trail
- Permanent Structure
- Temporary Structure
- SWMU Outline
- SWMU (point location)

3867-I

Figure 10-2:
Solid Waste Management Units (SWMU) in the Vicinity of the Thermal Treatment Unit near Technical Area (TA) 15, Building 184

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 500
Feet per inch on map = 100

SCALE 1:1200

NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.

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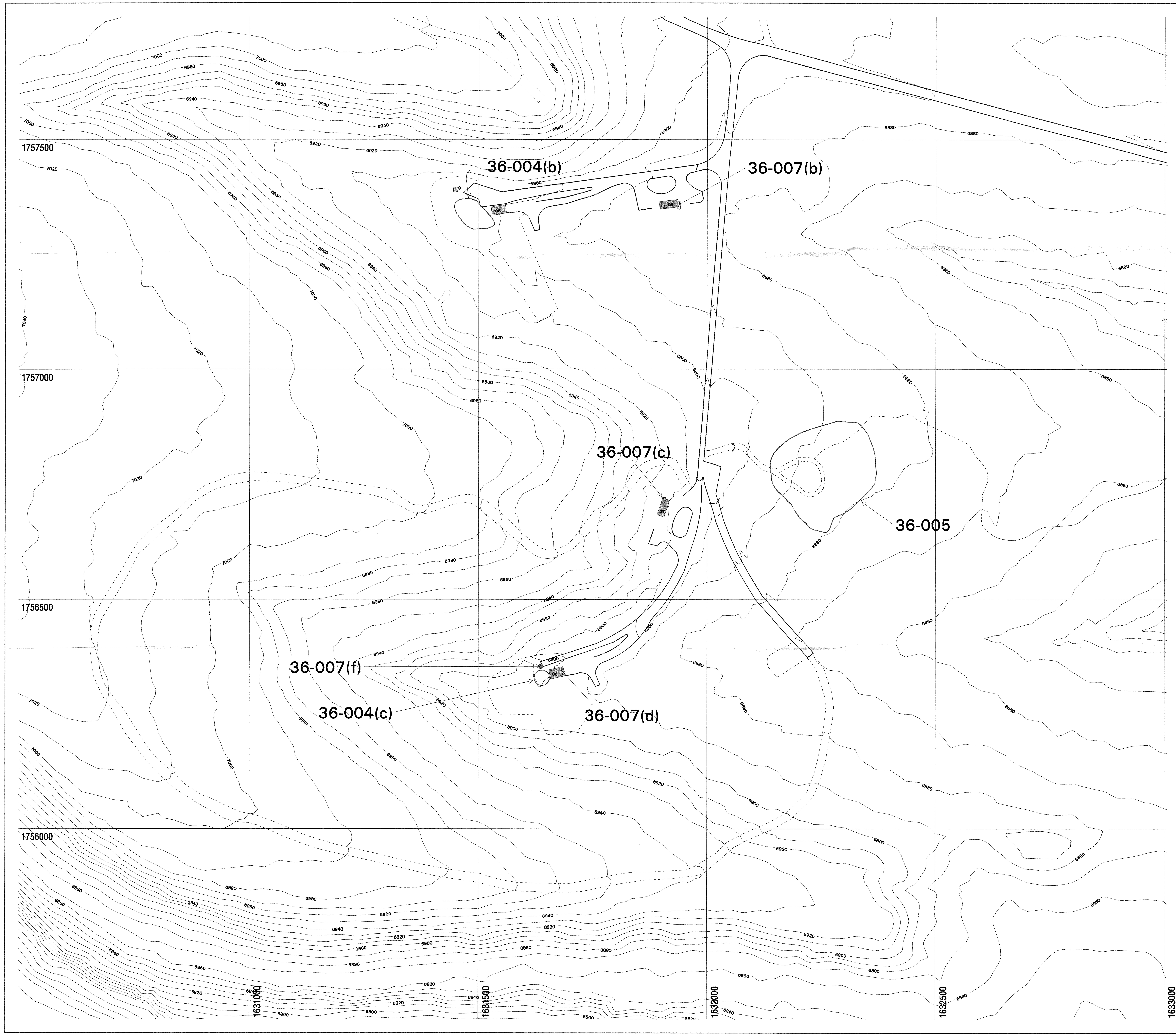

LEGEND

- Contour, 100 ft
- Contour, 10 ft
- Road, Dirt
- Road, Paved
- Road/Trail
- Permanent Structure
- SWMU Outline
- SWMU (point location)

3867-J

Figure 10-3:
Solid Waste Management Units (SWMU) in the Vicinity of the Thermal Treatment Unit near Technical Area (TA) 36, Building 8

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 500
Feet per inch on map = 100

SCALE 1:1200

0 30 60 90 120
METERS
0 100 200 300 400
FEET

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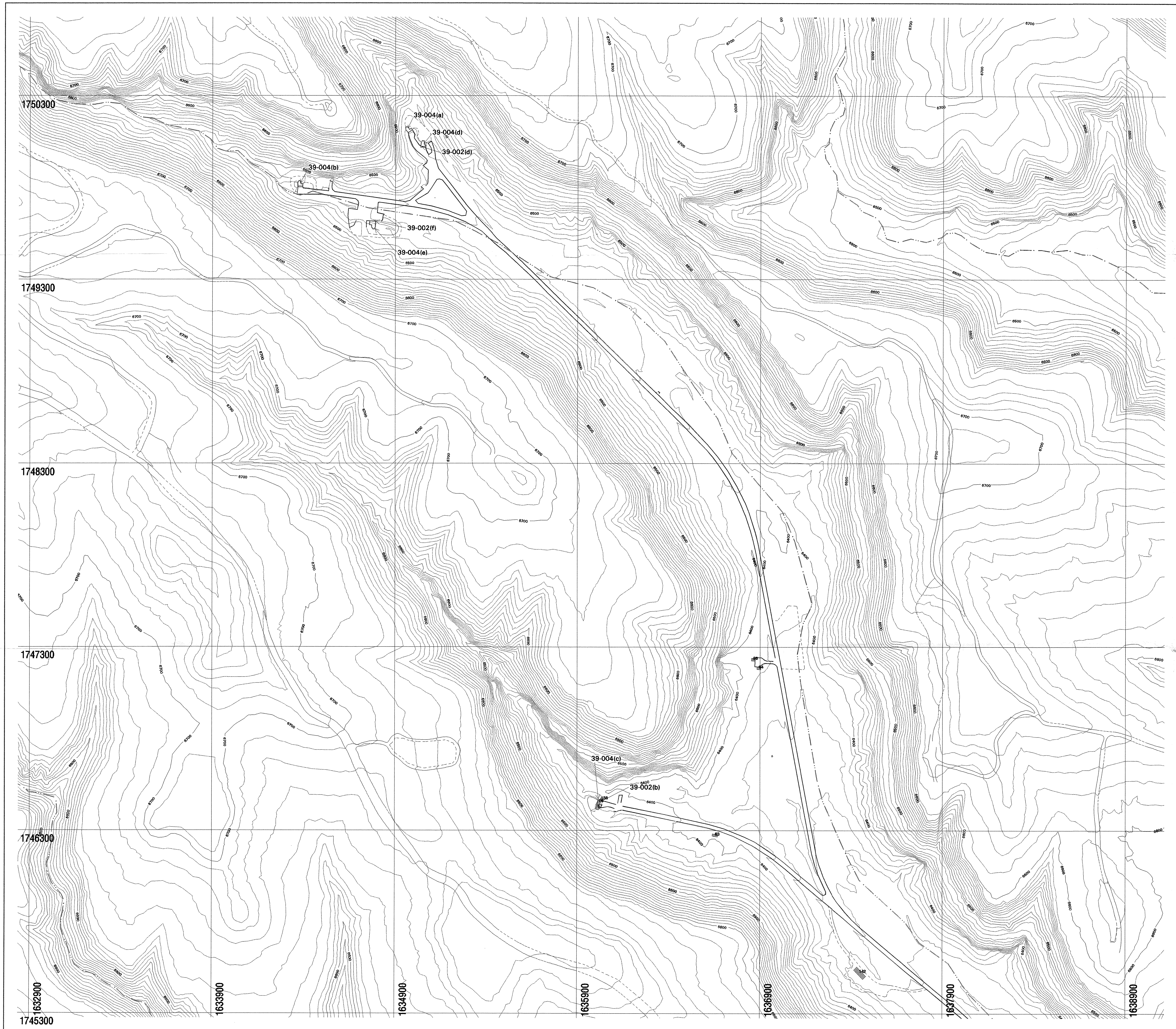

LEGEND

- Contour, 100 foot
- Contour, 10 foot
- Road, Dirt
- Road, Paved
- Road/Trail
- Stream, Intermittent
- Permanent Structure
- SWMU Outline

3867-K

Figure 10-4:
Solid Waste Management Units (SWMU) in the Vicinity of the Thermal Treatment Units near Technical Area (TA) 39, Buildings 6 and 57

N

State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 1000
Feet per inch on map = 250

SCALE 1:3000

0 76 152 228 304
METERS

0 250 500 750 1000
FEET

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Table 10-1

Solid Waste Management Unit (SWMU) Descriptions[a]

SWMU No.	Unit Type	Unit Description	Waste Description
14-001(a)	Pullbox	A 26- by 32- by 32-inch pit associated with Technical Area 14, Building 25 (TA-14-25) and used to house a capacitor discharge unit (CDU)	Various types of explosives, lead, uranium, strontium-90, and beryllium
14-001(b)	Pullbox	A 26- by 32- by 32-inch pit associated with structure TA-14-26 and used to house a CDU	Various types of explosives, lead, uranium, strontium-90, and beryllium
14-001(c)	Pullbox	A 26- by 32- by 32-inch pit associated with structure TA-14-27 and used to house a CDU	Various types of explosives, lead, uranium, strontium-90, and beryllium
14-001(d)	Pullbox	A 26- by 32- by 32-inch pit associated with structure TA-14-28 and used to house a CDU	Various types of explosives, lead, uranium, strontium-90, and beryllium
14-001(e)	Pullbox	A 26- by 32- by 32-inch pit associated with structure TA-14-29 and used to house a CDU	Various types of explosives, lead, uranium, strontium-90, and beryllium
14-001(g)	Firing Site	An active firing site located approximately 75 feet south of TA-14-23 used for open detonations (OD) involving explosives	Various types of explosives, lead, beryllium, strontium-90, and uranium
14-002(c)[b]	Decommissioned firing site	An 11- by 18- by 10-fee[illegible] building (TA-14-5) that formerly served as the control building for firing pads [SWMU Nos. 14-002(d and e)	Various types of explosives; possibly metals including lead, beryllium, and uranium
14-002(d)[b]	Decommissioned firing site	One of two firing pads associated with TA-14-5 and formerly used for explos[illegible]s testing	Various types of explosives; possibly metals including lead, beryllium, and uranium

Refer to footnotes at end of table.

Table 10-1 (Continued)

Solid Waste Management Unit (SWMU) Descriptions[a]

SWMU No.	Unit Type	Unit Description	Waste Description
14-002(e)[b]	Decommissioned firing site	One of two firing pads associated with TA-14-5 and formerly used for explosives testing	Various types of explosives; possibly metals including lead, beryllium, and uranium
14-003[b]	Burning Area	Bermed area approximately 600 feet east of TA-14-23 and formerly used to burn explosives-contaminated materials	Various metals, including barium and beryllium; and radionuclides
14-004(a)	Storage Area	Satellite storage area located at TA-14-22	Scrap explosives and explosives-contaminated items
14-004(b)[b]	Storage Area	Satellite storage area located at TA-14-23	Scrap explosives and explosives-contaminated items
14-004(c)	Storage Area	Satellite storage area located at TA-14-35	Scrap explosives and explosives-contaminated items
14-005[b]	Burn Cage	An approximately 3-foot-tall steel and wire mesh unit situated on a steel burn tray	Explosives-contaminated paper and laboratory equipment
14-006[b]	Sump	A 4.5- by 8.3- by 4.8-foot steel and concrete sump, an associated drainline, and an outfall area serving TA-14-23	Various components of the sump may be contaminated with explosives
14-007[b]	Septic System	A 4- by 7- by 6-foot reinforced concrete septic tank system that formerly served TA-14-6	Sanitary wastes and possibly photographic darkroom chemicals (e.g., organics, silver, cyanide)
15-003[b]	Firing Site	A 12- by 24- by 0.5-foot steel pad and two bunkers associated with the TA-15-184 firing site and used for OD involving explosives	Barium, lead, mercury, depleted uranium, thorium, beryllium, gallium, and residual explosives
15-004(h)	Firing Site	Inactive firing site located at TA-15	Uranium-238, beryllium, lead, and residual explosives

Refer to footnotes at end of table.

Table 10-1 (Continued)

Solid Waste Management Unit (SWMU) Descriptions[a]

SWMU No.	Unit Type	Unit Description	Waste Description
15-006(a)[b]	Firing Site	A chamber associated with the TA-15-184 firing site	Barium, lead, mercury, depleted uranium, thorium, beryllium, gallium, and residual explosives
15-009(g)[b]	Septic system	A 610-gallon septic tank and associated plumbing that serves TA-15-184	Sanitary waste and possibly mixed waste
15-010(c)[b]	Drain	A drain serving the camera firing point at TA-15-92	Unknown
15-013(a)	Storage tank	A 1,036-gallon underground storage tank (TA-15-192) that was relocated in 1959	Propane
15-013(b)[b]	Storage tank	A 15,000-gallon underground storage tank (TA-15-287) that was removed in 1992	Mineral oil
15-014(d)	Drainline	A drainline located near TA-15-184	Nonhazardous water
15-014(e)	Outfall	An outfall that receives wash water from floor drains located in TA-15-185	Nonhazardous wash water
15-014(l)[b]	Drainline	A drainline that drains cooling water from TA-15-202 into Water Canyon	Cooling water
36-004(b)	Meenie Firing Site	Active firing site located at the headwaters of Fence Canyon in TA-36	Depleted uranium, heavy metals, plastics, explosives, and various chemicals
36-004(c)	Firing Site	Active firing site in TA-36 located approximately 800 feet south of the Meenie Site and used for armor-piercing experiments and for OD involving explosives	Depleted uranium, heavy metals, plastics, explosives, and various chemicals

Refer to footnotes at end of table.

Table 10-1 (Continued)

Solid Waste Management Unit (SWMU) Descriptions[a]

SWMU No.	Unit Type	Unit Description	Waste Description
36-005[b]	Storage area	A surface storage area located near TA-36-7 that was formerly used to store large waste items used in explosives testing	Metal drums and cans, cylinders, and scrap metals such as lead sheets, copper, uranium-contaminated steel, and iron
36-007(b)	Waste storage container	A small, plastic-lined, corrugated cardboard box located in TA-36-5	Solid waste contaminated with explosives
36-007(c)	Waste storage container	A small, plastic-lined, corrugated cardboard box located in TA-36-7	Solid waste contaminated with explosives
36-007(d)	Waste storage container	A small, plastic-lined, corrugated cardboard box located in TA-36-8	Solid waste contaminated with explosives
36-007(f)	Waste storage container	A small, plastic-lined, corrugated cardboard box located at a firing site near TA-36-8	Solid waste contaminated with explosives
39-002(b)	Storage area	An approximately 5- by 5-foot portion of a concrete pad outside of TA-39-6	Waste solvents (e.g., ethanol, acetone, trichloroethane, copper sulfate); transformer oil; vacuum grease; and photographic wastes
39-002(d)	Storage area	Gravel pad located outside of TA-39-57	Waste solvents (e.g., ethanol, acetone, trichloroethane, copper sulfate); transformer oil; vacuum grease; and photographic wastes
39-002(f)	Storage area	Portion of an asphalt driveway located outside of TA-39-88	Waste solvents (e.g., ethanol, acetone, trichloroethane, copper sulfate); transformer oil; vacuum grease; and photographic wastes
39-004(a)[b]	Firing Site	A 500-square-foot area associated with TA-39-7 and used for explosives test detonations	Residual explosives, uranium, mercury, lead, beryllium, and dielectric oil containing polychlorinated biphenyls (PCB)

Refer to footnotes at end of table.

Table 10-1 (Continued)

Solid Waste Management Unit (SWMU) Descriptions[a]

SWMU No.	Unit Type	Unit Description	Waste Description
39-004(b)[b]	Firing Site	A 1,500-square-foot area associated with TA-39-8 and formerly used for explosives test detonations; operations at this unit were discontinued in 1980	Residual explosives, uranium, mercury, lead, beryllium, and dielectric oil containing PCBs
39-004(c)[b]	Firing Site	A 1,600-square-foot area associated with TA-39-6 and used for OD of explosives	Residual explosives, uranium, mercury, lead, beryllium, and dielectric oil containing PCBs
39-004(d)[b]	Firing Site	A 1,590-square-foot area associated with TA-39-57 and used for OD of explosives	Residual explosives, uranium, mercury, lead, beryllium, and dielectric oil containing PCBs
39-004(e)[b]	Firing Site	A 7,700-square-foot area associated with TA-39-88 and used for OD of explosives	Residual explosives, uranium, mercury, lead, beryllium, and dielectric oil containing PCBs

a Information compiled from Los Alamos National Laboratory (LANL) 1990, "Solid Waste Management Units Report"; U.S. Environmental Protection Agency (EPA), 1994, "Module VIII: Special Conditions Pursuant to the 1984 Hazardous and Solid Waste Amendments to RCRA for Los Alamos National Laboratory, EPA I.D. NM0890010515," effective date May 19, 1994; LANL, 1994, "RFI Work Plan for Operable Unit 1085"; LANL, 1993, "RFI Work Plan for Operable Unit 1086"; LANL, 1993, "RFI Work Plan for Operable Unit 1130"; and LANL, 1993, "RFI Work Plan for Operable Unit 1132."

b SWMU is identified in EPA, 1994, "Module VIII: Special Conditions Pursuant to the 1984 Hazardous and Solid Waste Amendments to RCRA for Los Alamos National Laboratory, EPA I.D. NM0890010515".

11.0 OTHER FEDERAL LAWS

A discussion of federal laws, as required by the New Mexico Administrative Code, Title 20, Chapter 4, Part 1, Subpart IX, 270.3 and 270.14(b)(20), revised November 1, 1995, is provided in Section 11.0 of the Los Alamos National Laboratory General Part B.

12.0 CERTIFICATION

In accordance with the New Mexico Administrative Code, Title 20, Chapter 4, Part 1, Subpart IX, 270.11(d), revised November 1, 1995, 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.

Robert H. Day
10/6/97

Robert H. Day
Division Director for Dynamic Experimentation Division
Los Alamos National Laboratory
Operator

Date Signed

for DJE
10/7/97

Dennis J. Erickson
Division Director for Environment, Safety, and Health Division
Los Alamos National Laboratory
Operator

Date Signed

G. Thomas Todd
10.8.97

G. Thomas Todd
Area Manager, Los Alamos Area Office
U.S. Department of Energy
Albuquerque Operations
Owner/Operator

Date Signed

13.0 LIST OF REFERENCES

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TA14

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Revision 1.0
October 1997

Part B Permit Application Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39

Volume II

Prepared by:

Los Alamos National Laboratory
Hazardous and Solid Waste Group (ESH-19)
Los Alamos, New Mexico 87545

Document:	LANL OB/OD Part B
Revision No.:	1.0
Date:	October 1997

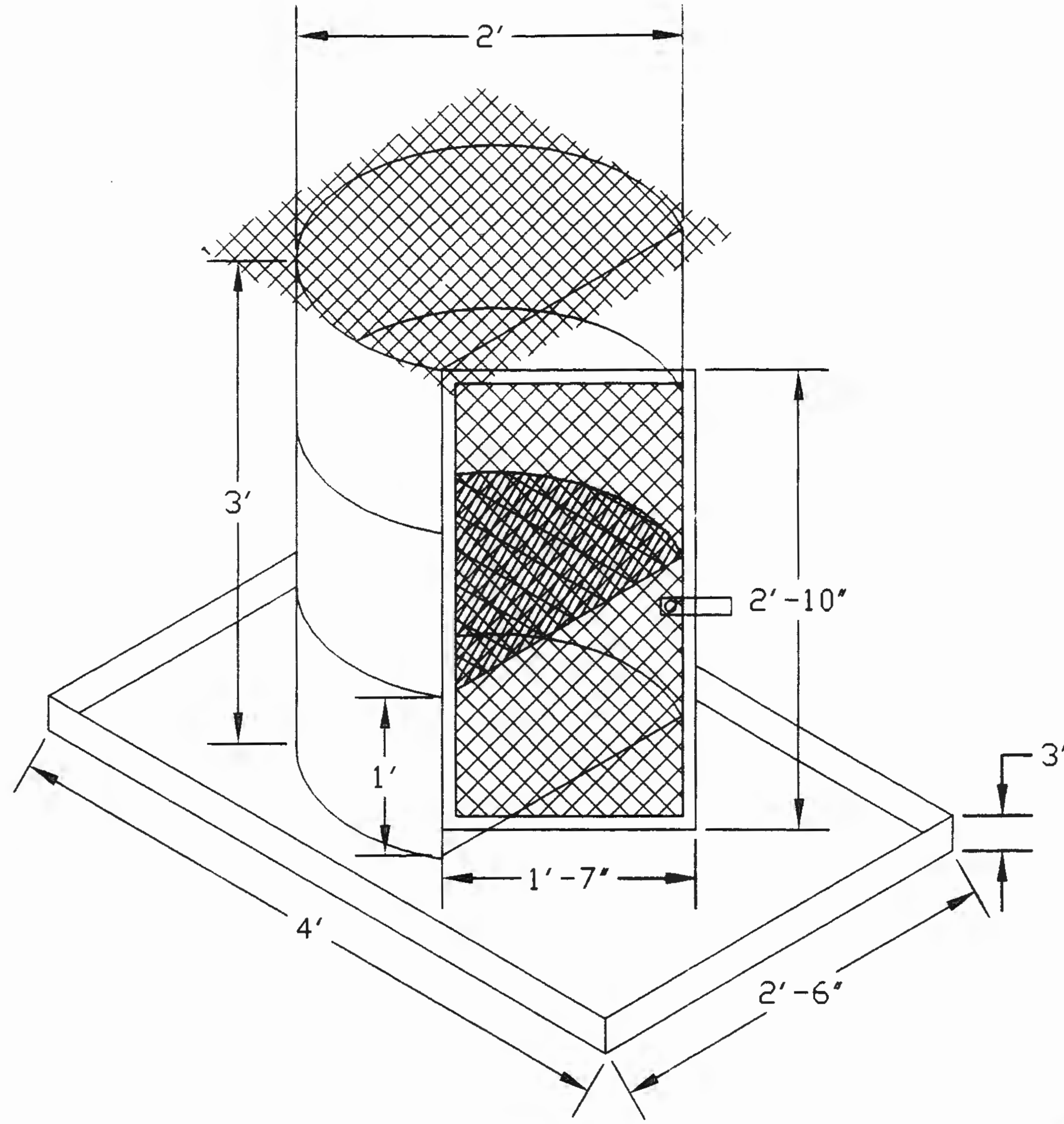
Part B Permit Application
Open Burning/Open Detonation Units at Technical Areas 14, 15, 36, and 39

Volume II

Prepared by:
Los Alamos National Laboratory
Hazardous and Solid Waste Group (ESH-19)
Los Alamos, New Mexico 87545

Appendix A

Engineering Drawing of the Technical Area 14 Open Burning Unit



NOT TO SCALE

JEFFREY K. TUCKER
NEW MEXICO
12183
REGISTERED PROFESSIONAL ENGINEER

NO	DATE	CLASS REV.	REVISIONS	DWN	DES	CHKD	REL	SUB	REC	APP

INTERNATIONAL TECHNOLOGY CORPORATION

THERMAL TREATMENT (OPEN BURNING) UNIT NEAR TA-14, BLDG 23

TA-14

DRAWN	D. MEADOWS
DESIGN	-
CHECKED	J. TUCKER
RELEASED	K. MUNYON
DATE	08-22-97

SUBMITTED | RECOMMENDED | APPROVED

Los Alamos — Los Alamos National Laboratory

SHEET 1 OF 1

CLASSIFICATION: | REVIEWER: | DATE:

PROJECT ID 766969.10 | DRAWING NO | REV

Appendix B

Standard Operating Procedures
Applicable to Open Burning/Open Detonation Thermal Treatment Units

Disclaimer

The standard operating procedures (SOP) in this document are for informational purposes only. These SOPs are the most current available and are amended periodically.

DX-4

STANDARD OPERATING PROCEDURE

FOR

Q-SITE EAST (TA-14) FIRING OPERATIONS

SOP 27

Prepared by: K. J. Uher — Date: 8/6/97
K. J. Uher, DX-2

Reviewed by: James R. Snow — Date: 8/11/97
J. R. Snow, DX-2 Group Leader

Approved by: G. D. Vasilik — Date: 8/4/97
G. D. Vasilik, DX-4 ES&H Officer

Approved by: J. M. McAfee — Date: 8/11/97
J. M. McAfee, DX-4 Group Leader

Approved by: A. L. Cucchiara — Date: 9/2/97
A. L. Cucchiara, ESH Deployed Team Leader

Approved by: C. M. Montoya — Date: 9/11/97
C. M. Montoya, DX-DO Operations Leader

Controlled Document Number:

TABLE OF C⌣NTENTS

1.0 INTRODUCTION

High-explosive (HE) firing operations are carried out at Q-Site in Technical Area 14 (TA-14). This site is located south of the R-Site Road between TA-9 and R-Site. Q-Site is operated by DX-2 under the auspices of DX-4. Q-Site East is a relatively small area that contains four buildings: one for general storage of equipment, two for storage of HE, and one that consists of the control room, laboratory, and make-up room.

2.0 PURPOSE

This Standard Operating Procedure (SOP) describes methods to be followed for firing tests and related operations at Q-Site East (TA-14), Buildings Q-6, Q-22, Q-23, and Q-24 and outdoor firing areas located south of the control room. Building Q-5 is condemned and is not approved for any operations.

3.0 SCOPE

This document describes the procedures required for personnel to perform tests at Q-Site.

3.1 Facilities and Uses

This SOP covers the facilities in Q-Site East only and does not address the facilities in Q-site West.

3.1.1 Building Q-6

Building Q-6 is a frame structure used to store parts and instruments that are used in various experiments. ***No explosives are permitted in this building.***

3.1.2 Building Q-23

Building Q-23 is a reinforced concentrate structure divided into four rooms (see Figure 1 for floor plan). The south face is protected by ½-inch steel boilerplate. The portholes are protected by sliding steel covers.

Figure 1

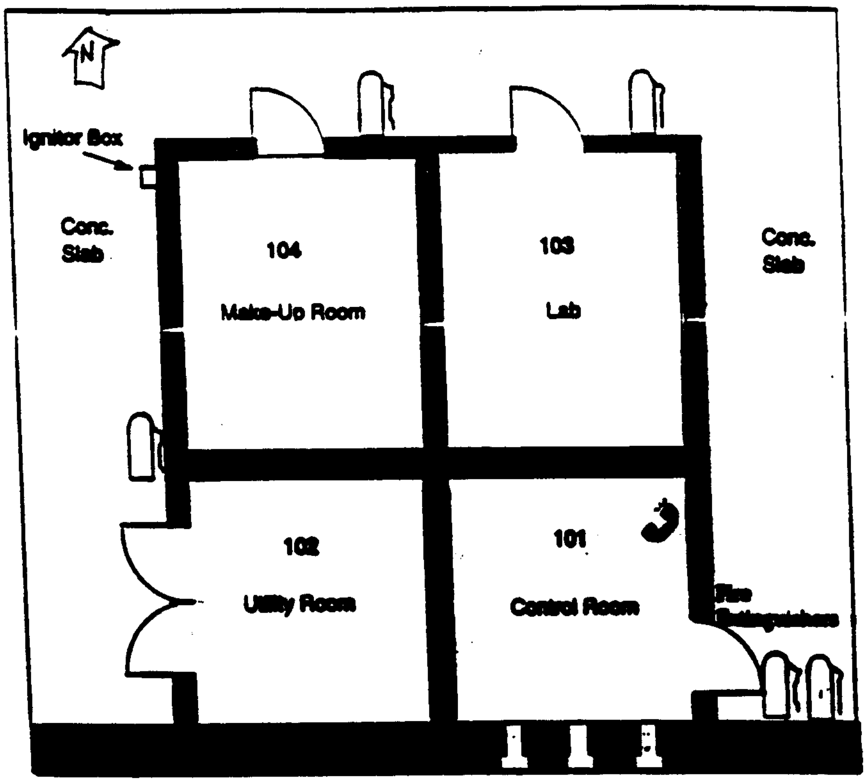


Fig. 1. Floor plan of Building Q-23, TA-14.

3.1.2.1 Room 101

Room 101 is the firing control room. Various items necessary for safe firing (locked capacitor discharge unit (CDU) controls and timed interlocks) and the equipment for recording data from the tests are installed in this room. ***No explosives are allowed in this room at any time.***

3.1.2.2 Room 102

Room 102 is the utility room and is not used for explosives work. This room contains the circuit breaker panels, the hot water tank, and the heating system. It is also used for storage of fire-fighting equipment such as hoses, shovels, and hoes. ***No explosives are permitted in this room.***

3.1.2.3 Room 103

Room 103 is used as a chemical laboratory. This room also contains a hood with water, gas, and vacuum lines. The lights, switches and electrical outlets are explosion proof.

3.1.2.4 Room 104

Room 104 is the make-up room in which test components are made up in preparation for firing. Made-up tests or explosives components may be stored in this room during a firing operation involving a large number of tests that may take several days to fire. No HE is to be stored in this room except for on-going experiments where the HE is part of a set-up that cannot be placed in a magazine. The electrical wiring in the room is explosion proof.

3.1.2.5 Ignitor Box

The ignitor box is a small steel box attached to the west side of this building and is secured by a padlock. This box is used to store ignitors. This box contains only Group B explosives. The key is under the control of the Firing Leader.

3.2 Firing Mounds

Besides the structures described, Q-Site East has five firing mounds located along a conduit system extending toward the South from the firing control room. Each firing mount consists of sand-covered area about 50 ft in diameter. Each mound contains a steel-covered underground box (firing pit) that provides GFCI Protected electrical outlets, telephone connections and space for the high-voltage CDU. Figure 2 shows the layout of Q-Site East, and the firing pits are shown as structure numbers 25, 26, 27, 28, and 29.

Figure 2

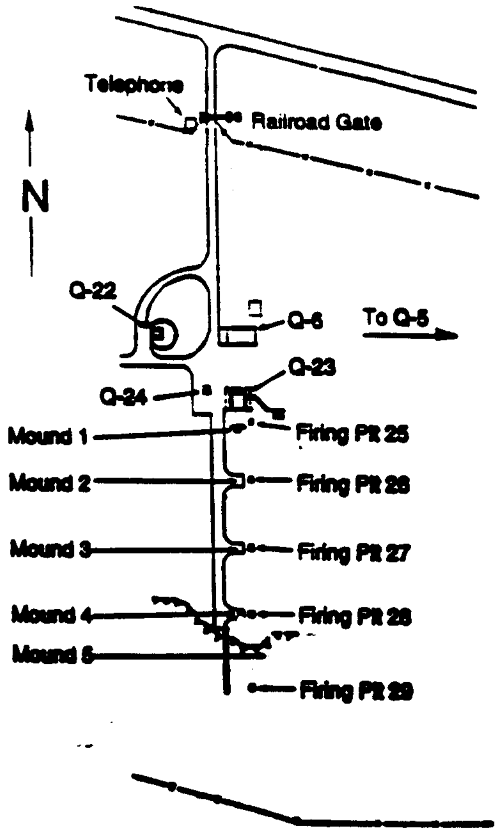


Fig. 1. Q-Site East.

3.2.1 Mound 1

Mound 1 is shielded on three sides with a 3-ft-high, ½-inch steel plate backed with sand. In addition to the 110-volt outlet, Mound 1 also has a 208-volt outlet.

3.2.2 Mound 2

Mound 2 has no shielding but has a heavy steel base plate and is in a direct line with the portholes in building 23.

3.2.3 Mound 3

Mound 3 is an open area used for general firing operations. This is also the location of the OB/OD Thermal Treatment Area.

3.2.4 Mound 4

Mound 4 has a shrapnel barrier constructed of large concrete blocks. This barrier is used for tests that may produce shrapnel or metal fragments.

3.2.5 Mound 5

Mound 5 is located in the canyon and is a reinforced-concrete-lined area cut into the side of the hill, which can be sandbagged on the southern (open) face.

4.0 DEFINITIONS

Energetic Materials	An energetic material is any material that liberates energy with or without oxygen which includes but is not limited to explosives, propellants, pyrotechnics and gas generants.
Firing Leader	A full time DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This persons accumulated knowledge and experience are crucial to all explosives firing operations.
OB/OD	RCRA Open Burn/Open Detonation.
Staff Member in charge of Q-Site	Oversees Firing Operations and experiments conducted at Q-Site
Tests with Staff	Experimental tests that have not been run before must be supervised by the requesting staff member and require a completed DX-2 Q-Site Test Sheet (Attachment 1), approved by the staff member in charge of Q-Site East.
Tests Without Staff	Tests that have been performed previously can be performed by a technician. It is not necessary that a staff member supervise the operation. This requires prior signature approval, on the test sheet, from the staff member in charge of Q-Site East.

See DX-4 SOP 3 General Safety, DX-4 SOP 4 General Firing Operations, and DX-4 SOP 5 Preparation room Operations and Explosive Charge Handling for further definitions.

5.0 RESPONSIBLILITIES

5.1 Staff Member in Charge of Q-Site East

- Recommends to the DX-4 Group Leader personnel who may be authorized as the Firing Leader.
- Is responsible for experiments conducted at Q-Site.

5.2 All other responsibilities are identified in DX-4 SOPs 3 & 4

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Electrical Work

All electrical work shall be conducted in accordance with the LANL Electrical Safety Program.

6.2 Explosive Load and Personnel Limits for Buildings

Limitations on explosive loads and personnel are given below for the different buildings covered in this SOP.

Location	Explosive Load Limit	Personnel Limit
Room 101 - Control Room	N/A	• 3
Building Q-23 Room 103 - Laboratory	50 lb including no more than 5 lb scrap HE	• If explosives present 3 • If no explosives present, 6
Room 104 - Make-Up Room	50 lb including no more than 5 lb scrap HE	• If explosives present 3 • If no explosives present, 6
Steel Box on NW corner of Building	100 ignitors	N/A
Building Q-6	0 lb	No limit
Personnel limits may be waived by the DX-4 Group Leader, or designee for tests, safety inspections, operational reviews, and demonstrations.		

6.2.1 Explosive and Personnel Limits for Mounds

6.2.1.1 Bare or Glass - or Plastic-Cased Explosives

Mound Number	Explosive Limit (lb)	Personnel Limit (when HE present)
1	5	The minimum required-not to exceed 3
2	5	The minimum required-not to exceed 3
3	20	The minimum required-not to exceed 3
4	30	The minimum required-not to exceed 3
5	30	The minimum required-not to exceed 3

6.2.1.2 Metal-Cased Explosives

Metal-cased/clad tests may be fired within the shrapnel barrier of Mound 4, (See Attachment 4, Bill Davis' Rule for the Evaluation of Fragment Hazards Calculation). Tests may be also be fired at Mound 5, provided the test is sandbagged on the exposed south side. No metal-confined tests are allowed at the other mounds.

6.3 Allowed Explosives

Only explosives that satisfy both of the following criteria can be used in operations at Q-Site East:

- Type 12 Drop-weight Impact > 12 cm
- Spark sensitivity >0.1 J for 3 mil foil

Energetic materials to be tested at Q-Site that have been characterized or are known to be impact or spark sensitive will require that the DX-2 Group Leader, Deputy Group Leader, or Staff Member in charge of Q-Site give written permission (SWP) before the material is taken to Q-Site. The handling procedure and precautions for this material must be stated on the Test Sheet.

6.4 Operations Limitations

No more than one firing operation may be carried out at Q-Site East at any one time.

Before starting a firing operation at Q-Site East, Q-Site West must be checked by doing a sweep of the area. Any personnel not associated with the testing will be escorted out of the area, and re-admitted after test completion.

6.5 Smoking

Smoking is not permitted at any time in or around any of the buildings, grounds, or firing mounds at Q-Site.

6.6 Flame-Producing Devices

No spark - or flame-producing devices, other than those used in firing or burning operations (such as ignitors), will be allowed in the area unless authorization has been given in an approved Special Work Permit (SWP). Firing site personnel are not to fight any fires involving HE.

6.7 Fire Protection

All the explosives processing and storage buildings are of concrete construction. See the restrictions in Section 7.3 of DX-4 SOP 3.0 General Safety.

6.7.1 Pyrophoric Materials

When materials of a pyrophoric nature are part of a test, Q-Site operators request the Fire Department to stand by with the necessary equipment to fight a possible fire in the surrounding woods (see DX-4 SOP 4 General Firing Operations, DX-4 SOP 1.0 General Access Control, Sections 6.3 and 7.1), (see7.1, this SOP "Preparations Before Firing).

6.7.2. Fire Fighting Equipment

6.7.2.1 Fire Extinguishers

Fire extinguishers are mounted on the east, north, and west walls, of Building Q-23 and on the east outside wall of Building Q-6. These fire extinguishers are checked annually by the Fire Department and monthly by the responsible person for Q-Site.

6.7.2.2 Other Tools

Shovels, long hoses, rakes, and hoes are stored in Room 102 of Building Q-23 for emergency fire fighting. This equipment is intended to quench small fires that are considered normal during firing operations. The Firing Leader will call the Access Control for any off-normal fires.

6.8 Maintenance

Weeds and brush are cut and cleared from the firing area and around buildings and magazines when necessary. A standing work order allows this maintenance whenever the brush and weeds present a fire hazard.

6.9 Visitor and Admittance Control

All visitors must check in at TA-9-21 for admittance.

6.9.1 Administrative Gate

This gate will remain locked and closed at all times except during normal firing site operations. The only exception to this will be when an explosive test is left on the firing mound overnight. Then both the Administrative Gate and the Railroad Gate will be closed. In the event of this, the Access Control Office at TA-15-183 should be notified. Access Control will make all necessary notifications. The Firing Leader will post a sign on the Administrative Gate and will notify the DX-2 Group Management.

6.9.2 Railroad Gate (Safety Gate)

A railroad gate, interlocked to the firing power source, is lowered at the entrance to Q-Site during any firing operation. A sign on this gate requires anyone entering the site, either by vehicle or on foot, to phone for entry from the telephone located on a post near the gate. The Q-Site East control room telephone number is 665-1787. Verbal clearance must be obtained from the Firing Leader before entering.

6.9.3 Remote Area Access

6.9.3.1 Access to Building Q-5

A chain gate located between Q-6 and Q-23 controls access to Q-5. When personnel are at Q-5, the chain will be down; when no one is at the site, the chain will be up.

6.10 Transportation of HE

Transportation of HE by vehicles to and within this area is covered by DX-DO SOP 3 Packaging and Transportation of Hazardous Materials.

6.11 Housekeeping

Special care must be taken to see that rooms 103 & 104 are kept free of loose explosive powder or dust that may be spilled during test makeup. After a day's operation, or more often if necessary, these rooms must be swept and the waste deposited in the appropriate HE waste cans.

Only brooms or brushes with no metallic parts and non-metallic dust pans are to be used to clean up spills. If the amount of explosive involved is more than a few grams and/or has an impact sensitivity of less than 10 cm with Type 12 tools and a 3-mil lead foil spark sensitivity of less than 0.05 J, the DX-2 Staff Member for Firing Operations or the Group Leader shall be informed and their advice obtained before the cleaning operation is performed. Attention should be paid to toxic hazards, as well as explosive hazards, and special protective clothing may be required.

6.12 Detonator Circuit Testing

A current-limited detonator current ohm (DCO) meter, meeting criteria set forth in the DOE Explosives Safety Manual, will be used if necessary, to check the resistance of exploding bridge wire detonators (EBWs). The meter shall be labeled "For Use on EBW Detonators Only".

6.13 Diagnostic Electronics Testing

A volt-ohm meter, such as a Fluke 77, will be used. It shall be prominently labeled "For Non-Initiating Circuits Only".

6.14 Low-Voltage Electro Explosive Devices (EED's)

Personnel that will be handling any low-voltage EED's will be properly trained. Training will consist of reading DX-1 SOP 175 and On the Job Training with firing site operations.

All electrical circuits will be grounded and shorted before continuity is established to the low-voltage EED. Personnel will be kept to the minimum needed to perform this operation. All others will remain in the control room during this operation. The procedure for connecting the CDU to the test assembly is as follows:

1. Check the shorting plug with an approved VOM for continuity. The resistance will be approximately 0.2 ohms.
2. Short the CDU end of the detonator cable with the shorting plug.
3. While using a wrist grounding strap, connect the EED to the detonator cable.
4. Attach the EED to the test assembly.

5. Remove the shorting plug from the detonator cable and connect the shorting plug to the load ring on the CDU.
6. Connect the detonator cable to the CDU.
7. Remove the shorting plug.

6.15 Safety Features

6.15.1 Railroad Gate

The railroad gate at the Q-Site entrance must be closed before the interlock on the control room door will close. Until the interlock is closed, no power will be available to the firing control unit.

6.15.2 Firing Control Unit

During a firing operation, the firing control unit in the control room provides built-in safety features through a timing sequence and a mechanism that will automatically stop the operation by grounding and interlocking the system (the CDU) when certain situations occur.

6.15.2.1 Timing Sequence

The power switch to the firing control circuit is a key switch, and when turned on, after the interlocks have been closed the following sequence of events occurs after the "TIMER" button has been pushed.

a. The siren sounds for 30 seconds.
b. The siren is silent for 30 seconds.
c. The siren sounds for 90 seconds.
d. A pilot light indicates "READY".
e. An operator ensures that the proper firing voltage has been selected. For EBWs the voltage is 2000 to 2500 volts DC.
f. The operator may then push the "POWER" and "ARM" buttons and wait for the CDU to charge.
g. The operator ensures that the firing voltage has been attained.
h. The operator may then push the "FIRE" button, and the test will fire. If this button is not pushed within 10 seconds, the entire circuit de-energizes and the cycle must be repeated.

6.15.2.2 Capacitor Discharge Unit

Characteristics of the the CDU are listed below.

a. The CDU may be installed in any one of the firing pits 25 through 29. It is connected to the fire-control unit by a special multiconductor cable.

b. When the "ARM" button on the fire control unit is pushed, power is supplied to the transformer and the rectifier so that the capacitors may charge.

c. A voltage divider network allows the capacitor voltage to be monitored at the fire control station with a 50-mA calibrated meter.

d. After firing or if a power interruption occurs during the firing sequence, the high-voltage capacitor are automatically shorted to ground. The ground circuit is routed through a set of contacts that are normally held closed by a spring. When the power circuit is energized, a solenoid overcomes the spring tension and breaks the ground circuit. The contact assembly is positioned so that, if there is a spring failure and/or a power interruption, the contacts will close and the system will be safely grounded. Timer interlocks prevent the ground circuit from being reopened until the timing and arming sequence has been re-established.

6.16 Viewing Ports

Visual inspection of the firing mounds or the general area may be made through portholes in the firing-room wall facing these mounds. These ports are equipped with three cylinders of 2-inch laminated safety glass to prevent fragments from entering the firing room.

6.17 Mound Spacing

The availability of five firing mounds at various distances from the control building provides safe distances for the tests. The most distant mound is located below ground level of the control room and space is cut into the side of the canyon wall to prevent fragments of from tests from reaching the control room or outside the designated clearance area.

6.18 Shelter

Building Q-23 is constructed of reinforced concrete with ½ inch boilerplate covering the side facing the firing mounds. This type of construction provides more than adequate shelter for personnel from any test fired according to the provisions of this SOP.

7.0 PROCEDURAL STEPS

7.1 Preparation Before Firing

Follow these steps when preparing a test for firing.

Step	Action
1	If a test involves pyrophoric materials,

	• Access Control at TA-15-183 arranges all Fire Department responses, except emergencies.
2	Fill out a DX-2 Q-Site Test Sheet (Attachment 1) and obtain approval from the staff member or the alternate in charge of Q-Site
3	Observe the weather: No firing operations are allowed during electrical storms, or in some cases, high winds.
4	The Firing key remains in the Firing Leaders possession.
5	• Prepare the appropriate firing mound with all the required diagnostics and blast shielding; • Record the diagnostic wiring on the Test Sheet (use additional pages if necessary); and • Make sure all diagnostics are working properly
6	Ensure that • the CDU is in place, • the load ring is shorted, • all necessary cables are connected, and • the detonator cable end is shorted
7	• Lower the (Safety) gate at the entrance to Q-Site and make sure that it is secured. **Note:** The green light on the firing panel will be lit when the gate is properly secured
8	• Clear the area by driving to Q-Site West (TA-14-34). Check the lower area (Mound 5) to make sure that no unauthorized personnel are within the site. • Alert all personnel at Q-Site West that a firing is to occur and escort them out of the area.
9	Take a head count to be sure all personnel are accounted for.
10	• Make certain that all diagnostic and initiating cables, wires, and connectors do not have any electrical potential. • Check all connections inside the control room, making sure that *no* cables or wires are hooked up to electrical generating devices.
11	• Check the firing mound for any potential structural or mechanical hazards. • Make sure that the mound is safe and stable.
12	• Instruct all personnel to stay in the control room in Building Q-23.

7.2 Setting Up a Test

To set up a test use the following steps.

Step	Action
1	Take the test to be fired out to the appropriate mound.

	Note: When the test is being set up on the mound, only the minimum number of personnel are allowed on the mound. All other personnel must stay in Building Q-23 Control room 101.
2	Attach all diagnostic cables (not firing cables) and wires to the test. If an ohm meter is required, make sure it has been approved for explosives use.
3	Once the test has been set up, casuals and observers may inspect the test under supervision of the firing site leader or operator.

7.3 Arming a Test

The Firing Leader or Operator should follow these steps when arming a test.

Step	Action
1	Initiate all tests with EBW detonators; other detonators will require an SWP.
2	• - Have all personnel go into Building Q-23, Room 101. • - Account for all personnel.
3	Bring the detonator out to the appropriate mound unless the test set-up requires earlier installation.
4	Perform one final check of the test and mound (see Steps 7, 11, and 12 in Section 7.1 above).
5	Instruct all remaining personnel to go into Building Q-23, Room 101. Note: Only the Firing Leader, who has the firing key in his possession, does not have to be in the Building.
6	Check to make sure shorting plug is on CDU before attaching detonator cable.
7	Connect the detonator cable to the detonator.
8	• - Make sure the detonator and the receptacle are free from any debris (sand, grit). • Attach the detonator to the test by screwing down the locking nut, but only finger tight. • Make sure the detonator is in contact with the booster explosive.
9	Remove the shorting plug from the CDU.
10	Go into the control room.

7.4 Firing a Test

The Firing Site Leader or Operator should follow the steps listed below when firir a test.

Step	Action
1	Review the firing check list (see Attachment III).
2	Close the control room door.

3	Unlock the firing control box.
4	• Start the semiautomatic firing sequence. • Continually monitor the fire-control system during the sequence until the capacitors are charged to at least 2000 volts (unless specified otherwise).
5	When the capacitors are charged, • push the "FIRE" button within 10 seconds, thereby firing the test.

IF	THEN
there is a malfunction	stop the firing sequence by interrupting the power.
the Firing Leader, operator or staff member feels there is a potentially unsafe situation	the Firing supervisor or operator will stop all firing operations

7.5 Post-Firing Operations

After firing the test, the Firing Leader should follow the procedures below.

Step	Who Does It	Action
1	Firing Leader	• Decides when it is safe to leave the shelter after the test.
2	Firing Leader	• Sounds the "All Clear" with two 5-second blasts of the siren.
3	Firing Leader	• Approaches the test area, • Ensures that area is safe, and • Notifies others in shelter of safe condition and that they may approach the area.
4	Firing Leader or Designee	• Pick up and place scrap and undetonated explosives in the approved HE waste container in Room 103 of Building Q-23. • Inspect entire firing area for explosives scrap at the end of the day's firing.
5	Firing Leader	At day's end, • lock all the buildings, and • check doors.

7.6 Misfires

In the event of a misfire, follow the procedure listed below.

Step	Who Does It	Action
1	All participants, including observers	Do NOT leave the control room.
2	Firing Leader	Checks all electrical connections to the power supply in the control room.
3	Firing Leader	Attempts to fire the test again, if it seems appropriate.
4	Firing Leader	If the test still fails to fire, • turn off all power to the power supply.
5	Firing Leader	Establishes a waiting period-at least 30 minutes if the cause of failure is not obvious.
6	Firing Leader	Observe the test assembly through the viewing ports in the control room, if possible, during the waiting period.
7	Firing Leader	If no activity in the test assembly is evident during this time, • carefully approaches the firing mound.
8	Firing Leader	Disarms the test by disconnecting the detonator cable at the CDU, if possible, or by removing the detonator from the charge or cutting its leads.

<table>
<tr>
<td>9</td>
<td>Firing Leader</td>
<td>Checks the leads for continuity and electrical connections to the firing unit using an approved DCO after disarming the test.
<table>
<tr><th>IF the trouble</th><th>THEN</th></tr>
<tr><td>has been located and fixed</td><td>check the operation of the unit by firing one or more detonators.</td></tr>
<tr><td>cannot be located</td><td>secure the site, leaving the barricade down, and
contact the Group Leader or the DX-2 Staff Member for Firing Operations for further instructions.</td></tr>
</table>
</td>
</tr>
</table>

7.7 Cleaning Up Contamination from Firing Operations

Sometimes normal firing activities will result in the incomplete detonation of the explosive and hence in the scattering of explosive in the area next to the test. For example, the standard gap test, by its inherent nature, will result in half of the tests scattering explosive.

The following steps are taken to minimize the contamination and to reduce the hazard from it.

Step	Action
1	The HE is collected from the test area after each test and put in the approved HE waste container kept in Room 104 of Building Q-23.
2	The entire firing area is inspected for explosives at the end of each day's firing.
3	The area is posted with a sign warning unauthorized personnel to remain out of the explosives-contaminated area.
4	No work is permitted in the posted area by service personnel without permission of the area coordinator and the firing leader or Group management.

7.7.1 Disposal of HE Operational Waste

The HE waste accumulated at Q-Site is disposed of in two ways,

(1) by arranging with the DX-Division Waste Coordinator to take away and dispose of such waste and

(2) by disposal at Q-Site

Waste minimization will be handled according to Section 13 of the DX-Division Operations Manual.

7.8 Emergency Procedures

The Building Emergency Plan (BEP) posted in Q-23 in TA-14 shall be followed in the event of an emergency situation. The BEP shall be available in the building, and the operators shall be familiar with its contents.

8.0 REQUIRED RECORDS

- Q-Site Test Sheet
- DX-2 Q-Site Firing Check List
- Adhesive and Potting Materials List
- Waiver of Personnel Limits at Q-Site
- Expended Material List

9.0 REFERENCES

- LANL Electrical Safety Program
  LIR402-600-01.0 "Electrical Safety"
  LIG402-600-01.0 "Electrical Safety Implementation Guide"
- DOE Explosives Safety Manual, DOE M440.1-1 Rev. 8
- Los Alamos Environment, Safety, and Health Manual
- DX-Division Operations Manual
- DX-1 SOP 175 Manufacture Handling, and Inspection of Low Energy EEDs
- DX-4 SOP 3.0 General Safety
- DX-4 SOP 4.0 General Firing Operations
- DX-4 SOP 5.0 Preparation Room Operations Explosive Charge Handling & Assembly
- DX-DO SOP 01 Waste Management in DX-DO
- DX-DO SOP 03 Packaging and Transportation of Hazardous Materials
- DX-DO SOP 06 Radiological Controls
- DX-DO SOP 08 HE Storage

10.0 ATTACHMENTS

1. DX-2 Q-Site Test Sheet
2. Adhesive and Potting Materials List
3. DX-2 Q-Site Firing Checklist
4. Evaluation of Fragment Hazards

Attachment 1

DX-2 Q-Site Test Sheet

Date ________________

Type of Test ___________________________________ Time ________________

Purpose of shot ____

____

Experimenter (s) ____________________ Program Code ______________________

Technicians (s) _____________________ Disk Name _________________________

Detonator ____

Booster ___________________________ Dimensions ________________________

____

Mound Location ___________________

Weight (grams) ___________________

Toxic or Radioactive Materials ____

(D-38, Lead, Tritium, Beryllium, etc.)

Fire Dept. Requested Yes No

If yes, why? ____

ESH Requested Yes No

If yes, why? ____

Special Procedures or requirements ______________________________________

____

Diagnostics Used (Scope, TIM, Pulse Amp., DDG, Fanout, etc.)

____

Approved by (Staff Member in charge of Q-Site East or alternate) __________________
(Use back of sheet for results and comments)

Attachment II

ADHESIVES AND POTTING MATERIALS

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
Epoxy	Aerobond 2017	Trimethoxy-boroxine	198	Compatible with HE. Exothermic reaction. Don't make more than 50 g at a time.
	Barco Bond 165 165, 185	Boron trifluoride complex	229	Due to its fast curing reaction this material becomes hot if used in thick sections. It should not be used for potting and large fillets should be avoided.
	VEEP 1579 VEEP 1579T	Versamid 140 DMP-30*	232	Not compatible with all HE. May be used on PBX 9502, TATB, and mixtures of TATB and inert materials.
	Epon 828	Versamid 125		Not to be used on HE materials. Exothermic.
	Epon 815	DETA (Diethylene-triamine)		Not to be used on HE materials. Exothermic.
	Torr Seal	Polyamide	230	Can be used on HE as described in report #230. Ideal for vacuum applications, sealing leaks.
Poly-Urethane	Aralhex spray brush, putty, or fillet.	Ferricacetyl-acetonate	223	Compatible with HE. Used for cover bonding. Exother-

ADHESIVES AND POTTING MATERIALS (Cont)

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
	Urethane Encapsulant 7200	Component "B" (polyol mix)	224	Compatible with HE 100% solids. Moisture contamination will cause severe foaming.
	Polad	Adiprene 5333	243	Compatible with HE. Adhesive of choice with Comp. B. Acetone diluent avoids sparks. Do not breathe vapors.
	Polamine 1000 cured polyurethanes		266	Compatible with HE. Slight foaming from moisture. Do not breathe vapors.
	Polycure cured polyurethanes		243	Compatible with HE. Slight foaming from moisture. Do not breathe vapors.
	Cyanacure cured polyurethanes		242	Compatible with HE. Slight foaming from moisture. Do not breathe vapors.
Cyano-acrylate	Eastman 910		67	Compatible with HE. Thin-film activated.
	Eastman 910 with accelerator	Phenylethyl-ethanolamine (chlorothene)	182	Can be used on HE as described in Report #182. Accelerator solution is applied to one surface and left 30 s for chlorothene to evaporate.
	Superbonder 414, 416, 420, 430, and 495		67	Compatible with HE. Limited to 0.004-inch gap fill.

ADHESIVES AND POTTING MATERIALS (Cont)

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
	Superbonder 414, 416, 420, 430, and 495			Not approved for HE compatibility. Up to 0.020-inch gap fill with accelerator.
	Threadlocker 242	May use Primer T		Not approved for HE compatibility. Limited to 0.005-inch gap fill.
	Threadlocker 290	May use Primer N		Not approved for HE compatibility. Limited to 0.005-inch gap fill.
Anaerobic	Speedbonder 324 and 325	Activator 707		Not approved for HE compatibility. Up to 0.040-inch gap fill.
	Loctite Depend	Depend Activator		Not approved for HE compatibility. Up to 0.030-inch gap fill.
Rubber	Bondmaster G458			Not to be used on HE. Will bond polystyrene and polyurethane foams. Contains volatile solvents
	Dow Corning 281		138	Compatible with HE. May be thinned with toluene.
RTV Silicones	DC 731, 732 GE 162	Moisture in air	48, 49	Compatible with HE.
	DC 3110 Rubber	S catalyst or F catalyst	144	Compatible with HE. Store in refrigerator.
	Kerr Denture Elasticon	Mixture of stannous octoate and zinc octoate	259	Compatible with HE.

ADHESIVES AND POTTING MATERIALS (Cont)

Category	Adhesive	Additive or Catalyst	HE Comp. Report #	Remarks
	DC Sylgard 184 186; DC Silastic J, E; GE RTV 615 McGhan-Nusil CF7-2615	Pt catalyst	149, 257	Compatible with HE. Store in refrigerator.
Spray	Photo Mount Spra Mount		220	Compatible with HE.
Dry Film	3M 465 and 920		227	Compatible with HE.
General Purpose	Duco Cement		57, 66	Compatible with HE.

Attachment III

DX-2 Q-Site Firing Checklist

Requester ____________ Charge Code ____________ Date Fired ____________

N/A	OK		
	❑	1)	Ensure Q-Site shot sheet is completed.
❑	❑	2)	Notify Access Control 7-6742 to arrange for Fire Department standby if pyrotechnics are involved in the shot.
	❑	3)	Notify Access Control of all shots.
	❑	4)	Lower TA-14 gate and clear the area.
	❑	5)	Move all personnel into Bldg. Q-23 and establish a head count.
❑	❑	6)	Ensure that there is no electrical potential to the firing mound and check all cables and connections.
❑	❑	7)	Take photos as necessary.
❑	❑	8)	Verify CDU is shorted with the shorting plug, then arm the shot.
❑	❑	9)	Remove CDU shorting plug.
❑	❑	10)	Retake head count and start firing sequence.
	❑	11)	Set correct firing voltage on the Control Panel.
❑	❑	12)	Ensure shot diagnostics and rack are powered and in a ready state:

OFF	ON	
❑	❑	DC Power Supply voltage set and connected.
❑	❑	Oscilloscope programmed and reset (recheck after charging).
❑	❑	TIM's, DDG's and Pulse Amplifiers programmed and reset.
❑	❑	VCR programmed and recording.

❑	❑	14)	Record shot time on shot sheet.
❑	❑	15)	Charge CDU and recheck diagnostics.
❑	❑	16)	Fire the shot.
❑	❑	17)	Record data from shot diagnostics.
❑	❑	18)	Check the area for shot-induced fire.
❑	❑	19)	Verify a safe condition on the mound and short CDU.
❑	❑	20)	Sound "all clear" when it is safe to leave Bldg. Q-23.
❑	❑	21)	Police the area for any unconsumed HE or hazardous debris and dispose of appropriately.

Signature: ____________________________ Date ____________

Firing Leader

DX-2 Q-Site Firing Checklist (Cont)

In the event of a misfire the following procedure will be followed:

N/A	OK		
	❑	1)	DO NOT LEAVE CONTROL ROOM
❑	❑	2)	Check all electrical connections and firing voltage in the control room.
❑	❑	3)	Attempt to fire the shot again.
❑	❑	4)	If the shot still does not fire, turn off all power to firing system.
❑	❑	5)	Wait a time considered appropriate by Firing Leader (nominally 30 minutes) observing the shot for any signs of smoke or activity.
❑	❑	6)	If during the waiting period no activity is observed, <u>one</u> person shall approach the firing mound pit and disconnect the detonator cable from the CDU.
❑	❑	7)	Remove or disconnect the detonator from the shot.
❑	❑	8)	Check detonator leads and cable for continuity with an approved DCO.
❑	❑	9)	If the problem has been identified and corrected, firing operations may be checked by firing one or more detonators.
❑	❑	10)	If the problem cannot be identified, notify the DX-2 Group Office 7-4411), secure the area, and await further instructions.

Attachment IV

Evaluation of Fragment Hazards

BILL DAVIS' RULE

$$\text{Fragment Distance} = \frac{\text{Density of Fragment}}{\text{Density of Air}} \times \text{Thickness of Fragment /(Ft.) in direction of travel} \times \text{Safety factor}$$

where:

Density of Air = 10^{-3} g/cm3 at Los Alamos altitude

Safety Factor: 5 for cars, and buildings
8 for people

FOR TYPICAL FRAGMENTS (NO BARRIER OR BARRICADES)

Material	Density g/cm3	Fragment Thickness (in.)	Fragment Distance (Ft.) (Safety Factor = 8)
Aluminum	2.7	¼"	450
		½"	900
		1"	1800
Brass	8.4	¼"	1400
		½"	2800
		1"	5600
DU	18.7	¼"	3116
		½"	6233
		1"	12,466 (2.3 miles)

Group M-1 TA-14-23
Emergency Plan
August 8, 1991

EMERGENCY PLAN

TA-14 Building 23

Originator ____________ Date 8/8/91

APPROVALS

____________ Date 9/10/91

M-1

Betty W. Harris Date 9/11/91

M-1 EMERGENCY COORDINATOR

[redacted]

Distribution:

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L. B. Chapman, M-1
R. D. Steele, M-1
G. A. Buntain, M-1
B. W. Harris, M-1
G. W. Taylor, M-1
TA-9 Branch Shop
M-1 Emergency Plan File

Emergency Plan

TA-14 Building Q-23

1. Building Description

Building Q-23 consists of four rooms; 101 control, 102 utility, 103 lab, and 104 make-up. The building measures 24 x 24 feet and is about 8 feet hight. It is constructed of 2 foot-thick steel reinforced concrete on the south side and 10 inch thick concrete on the other sides.

2. Building Hazards

Q-23 is permanently labeled with a "1" hazard sign. Rooms 103 (lab) and 104 (make-up) can contain up to 50 lbs of high explosive. Room 102 (utility) contains the electrical panels and circuit breakers.

3. Alarm Systems

None

4. Protection Systems

None

5. Emergency Equipment

Carbon dioxide fire extinguishers are outside rooms 101, 102, 103, and 104. Water fire extinguisher is outside room 101. MSDSs are located in Room 103. Two absorbent spill kits are located inside the solvent cabinet outside room 103.

6. Notifications

A. In case of fire, serious injury, or emergencies that pose an immediate threat to life or property:
- call 911 or 9-911;

- notify the M-1 Group Leader and the General Chemistry Section Leader. The M-1 Group Office will notify M-DO and HSE-3.

B. Incidents that do NOT pose an immediate threat to life or property, but carry the POTENTIAL of such a threat:
- Notify the Emergency Management Office at 7-6211 (7-7080 after hours).
- Notify the Group Office during normal hours.
- Notify the following during off hours:

Jim Stine	672-1314
Greg Buntain	662-6885
Larry Hatler	672-9150
Manny Lopez (utilities)	7-6191

C. Incidents that pose no threat to life or property, but yet may be reportable under DOE Order 5000.3A should be reported to the Emergency Management Office as soon as possible. Copies of DOE Order 5000.3A may be obtained from the Occurrence Reporting Section of EMO (7-6211).

D. Local Notifications:
None.

7. Emergency Planning Zone

Reserved for future use.

8. Actions Required in Event of Specific Major Incidents:

A. Toxic chemical release:

In the event of a toxic chemical spill in which a sufficient quantity of toxic vapors are released, personnel should evacuate upwind. It is important to warn other personnel in the immediate area and at the M-8 portion of TA-14 of the spill. The nature of the emergency will determine how large an area will need to be evacuated, so an assembly area cannot be designated in advance. However, if the wind direction permits, personnel should evacuate at the entrance gate to TA-14. There is a phone at this location and incoming emergence response personnel can be stopped and advised of the nature of the spill. *Under no circumstances will any* *emergency vehicle be permitted into TA-14 until the M-1 senior supervisor has determined that there is no further danger from explosions.*

All personnel who might have been exposed to toxic materials should seek medical treatment as necessary.

In the event of a chemical spill without toxic vapors, the Spill Coordinator for Group M-1 will be notified and all personnel will be evacuated from the vicinity of the spill. For small spills, personnel familiar with the material will do whatever they can to confine the spill, if it can be done safely without harm to themselves or others. For large spills, or those involving toxic chemicals HSE-3 will be requested to confine and clean up the spill.

B. Radioactivity release

N/A

C. Nuclear criticality

N/A

D. High energy accident

In the event of an explosion involving high explosives with or without a fire all personnel are to retire to a safe distance and remain there until the danger of an explosion is over. Violent, high-order detonations are unlikely to be followed by additional explosions unless an adjacent vehicle or building containing explosives has been damaged by the initial explosion or from a resultant fire.

Any fire involving substantial quantities of explosives represents an extremely hazardous situation. A violent explosion could occur at any time. Small explosions, unless they result in a fire, will probably be followed promptly, or not at all, by additional explosions.

Remaining in an area threatened by further explosions to help an injured person will probably not mean the difference between life or death to that person, but may well cause injury or death to the rescuer.However, if the wind direction permits, personnel should evacuate at the entrance gate to TA-14.

There is a phone at this location and incoming emergence response personnel can be stopped and advised of the nature of the explosion. *Under no circumstances will any emergency vehicle be* *permitted into TA-14 until the M-1 senior supervisor has determined that there is no further danger from explosions.*

9. General Evacuation Procedures

A. Date of evacuation routes/posters in use:
A map of Q-23 is located in the control room (room 101) and was last reviewed July 31, 1991. It shows the exits of Q-23 and the assemble point by the entrance gate to TA-14.

B. Provisions for handicapped employees:
Handicapped personnel are not allowed in explosives containing area if their handicap would endanger themselves or others. Handicapped visitors are allowed in the control room, but only under supervision of the Firing Supervisor. This room is easily accessed by wheelchairs. At this time, no handicapped personnel needing special provisions are employed in Group M-1.

C. Personnel accountability procedures:
The Firing Supervisor will have knowledge of all personnel in the area and a list of all visitors. He will check all personnel at the place of evacuation. The place of evacuation will usually be the entrance gate to TA-14, unless conditions warrant otherwise.

D. Special evacuation/transportation requirements:
The entrance gate to TA-14 is the assembly point for an evacuation. If this gate is down wind of a toxic gas plume, employees are to evacuate to a point up wind of the plume.

10. Emergency Operations

A. In-house Emergency Response Team consists of the Group Leader and the Deputy Group Leader. These people are familiar with the hazards of explosives and should be consulted by the Emergency Response personnel.

B. In-house communications capability - None.

C. Stand-Off Instructions. Personnel should evacuate to the entrance gate to TA-14. This position is provides a safe stand-off distance for nearly all conceivable accidents, and also provides a point of contact with the Emergency Response personnel before entrance to a potentially hazardous area.

11. Consequence Assessment

A. The senior building person present will give the arriving Incident Commander a breifing on current hazards and likely problems. EMO and responding HSE elements, in consultation with building staff/occupants, will conduct more detailed consequence assessment.

B. The consequences of any incident at TA-14 are essentially unpredictable. For this reason, the M-1 Senior Supervisor will assess the likelihood of a continuing hazard after an initial incident. General guidlines for this assessment are given in the M-1 Emergency Plan.

12. Shutdown Procedures

In the event of a fire or explosion in the vicinity of Q-23 the firing system will be shutdown. Under no circumstances, however, should personnel endanger themselves to do so, and no one may re-enter an evacuated building without the M-1 Senior Supervisor's specific permission.

13. Spill and Containment Procedures

A spill control kit is located outside room 102. This kit would be used in the event of a small spill, as long as it could be used without harm to the user or others. For large spills, the spill control coordinator would be notified.

14. Re-entry Procedures

The M-1 Group Leader is responsible for decisions about when the accident site may be re-entered by Group personnel. In general, no one should re-enter during the emergency, but only after sufficient time that all of the M-1 line management can assess each of the hazards.

15. Training

A. Emergency Training: The Firing Supervisor is required to have CPR and First Aid.

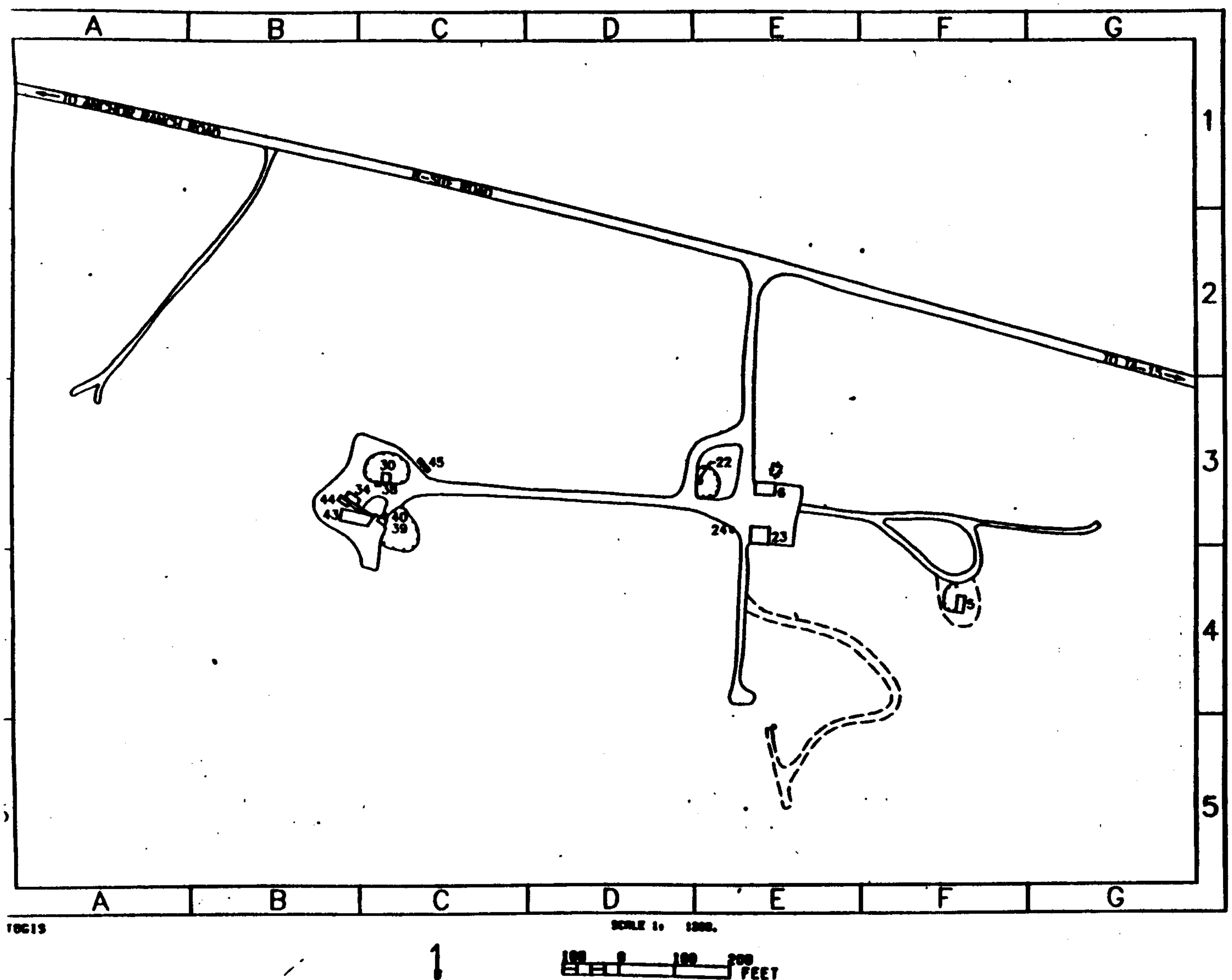
B. Periodic Evacuation Exercises: An emergency / evacuation exercise is performed annually by the M-1 Emergency Coordinator.

CALL LIST

Firing Site Supervisor	Ken Uher	5-4901*	662-7012
Building Manager	Jim Stine	7-4990*	672-1314
Alt. Building Manager	Ken Uher	5-4901*	662-7012
Gen. Chem. Section Leader	Greg Buntain	7-4748*	662-6885
Group Eng. Area Coord.	Bob Shelton	7-4411	662-4484

This document was prepared by James Stine, 8/2/91 Tel: 7-4990

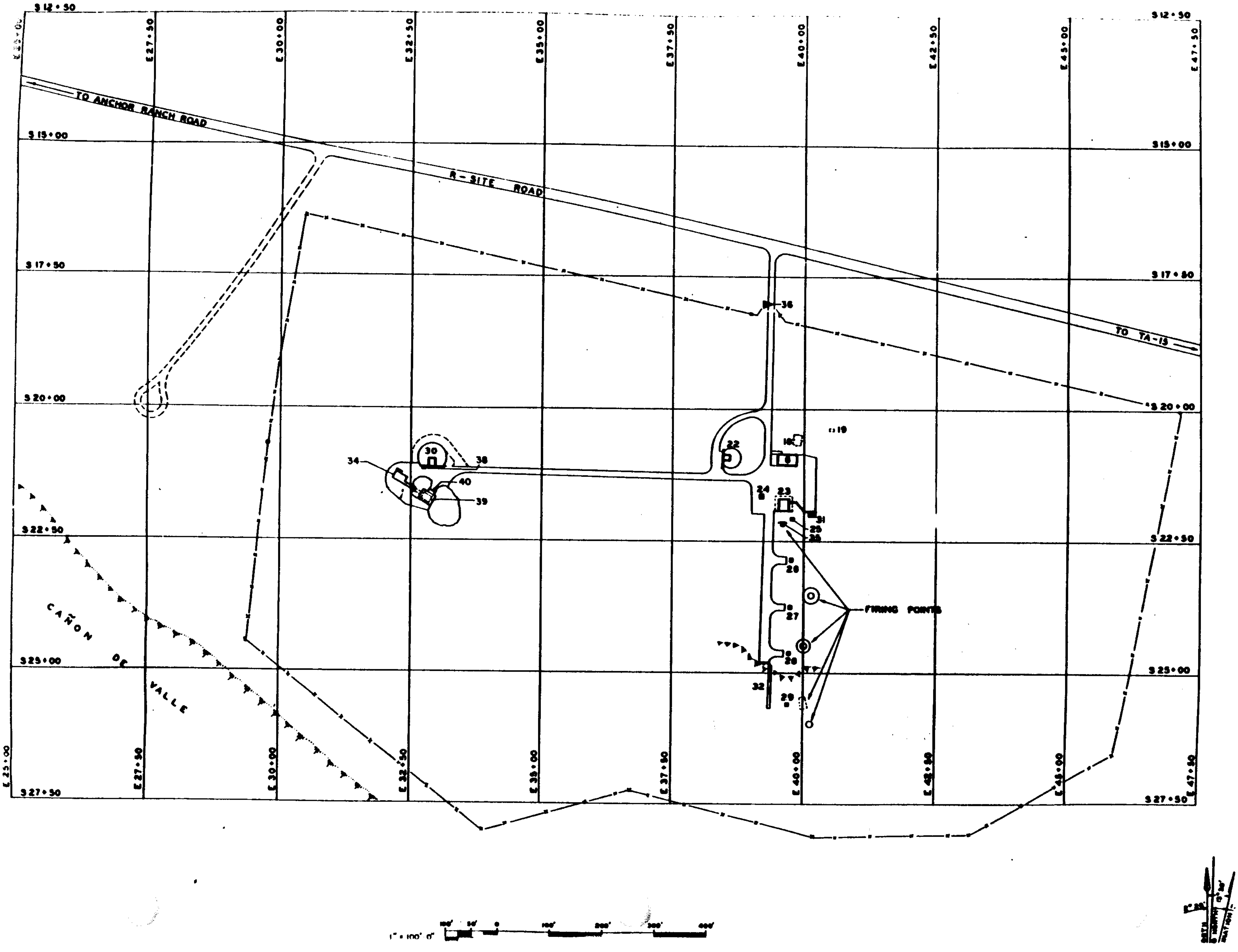
TA-14



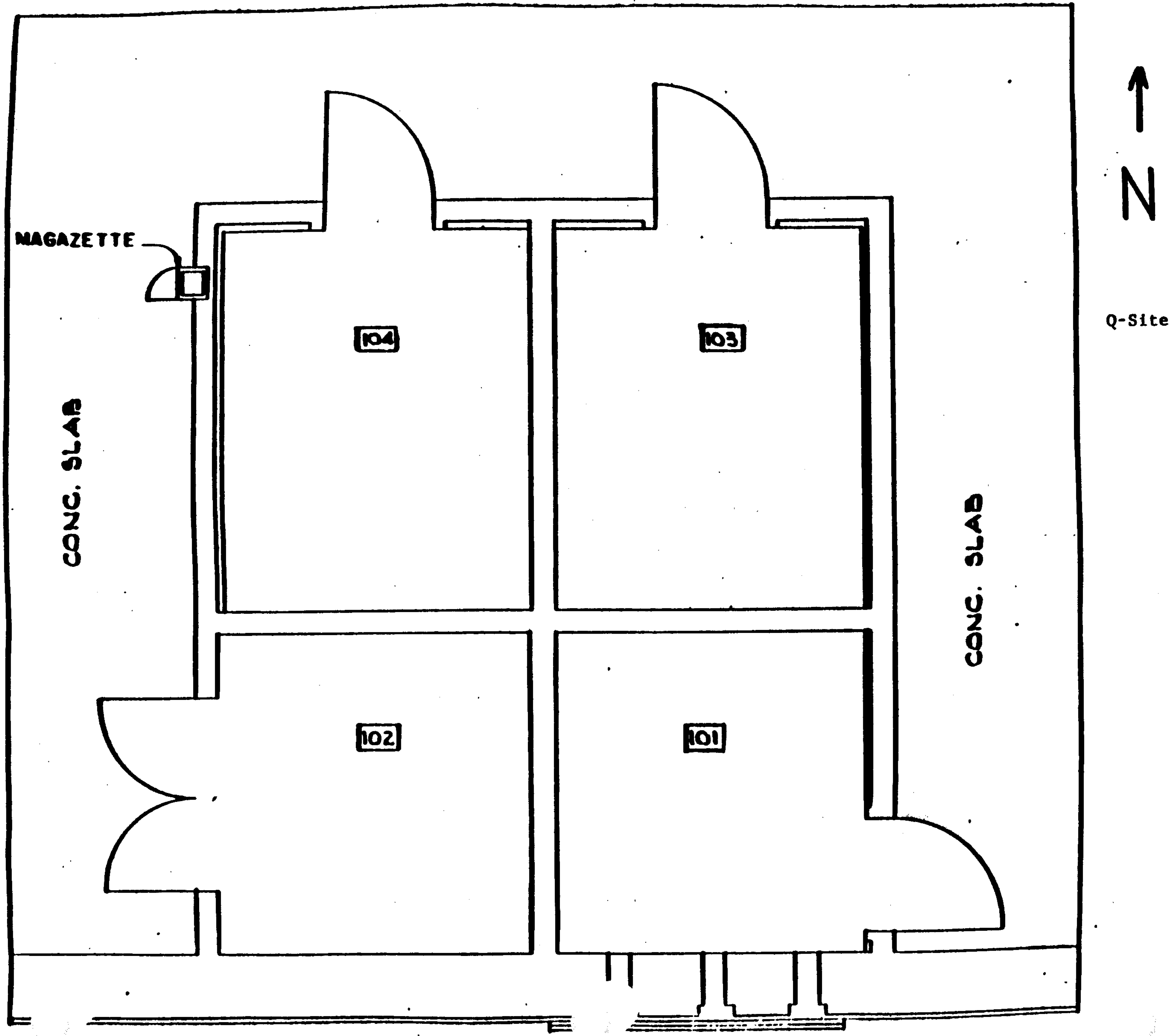
STRUCTURE NUMBER INDEX

STRUCTURE TA-NUMBER	STRUCTURE DESIGNATION	STRUCTURE NOMENCLATURE	STRUCTURE LOCATOR SHEET NO.	STRUCTURE LOCATOR MAP KEY
14- 5	Q- 5	BUNKER	1	F-4
14- 6	Q- 6	STORAGE BUILDING	1	E-3
14- 22	Q- 22	MAGAZINE	1	E-3
14- 23	Q- 23	CONTROL BUILDING	1	E-3
14- 24	Q- 24	EQUIPMENT BUILDING	1	E-3
14- 30	Q- 30	EXPLOSIVES PREP. BUILDING	1	C-3
14- 34	Q- 34	BULLET TEST FACILITY	1	B-3
14- 38	Q- 38	CAMERA BUILDING	1	C-3
14- 39	Q- 39	HIGH EXPLOSIVE TEST FAC.	1	C-3
14- 40	Q- 40	INSTRUMENTATION BUILDING	1	C-3
14- 43	14- 43	LABORATORY BUILDING	1	B-3
14- 44	14- 44	TRANSPORTAINER	1	B-3
14- 45	14- 45	TRANSPORTAINER	1	C-3

UNIVERSITY OF CALIFORNIA
Los Alamos
FACILITIES ENGINEERING DIVISION
STRUCTURE LOCATION MAP
TA-14 Q-SITE
ENG-R 5100



TO ANCHOR RANCH ROAD
R-SITE ROAD
TO TA-15
CAÑON DE VALLE
FIRING POINTS
S 12+50
S 15+00
S 17+50
S 20+00
S 22+50
S 25+00
S 27+50
E 25+00
E 27+50
E 30+00
E 32+50
E 35+00
E 37+50
E 40+00
E 42+50
E 45+00
E 47+50
1" = 100' 0"



Q-Site TA-14 Q23

DX-16

STANDARD OPERATING PROCEDURE

FOR

PACKAGING AND ON-SITE TRANSPORTATION OF EXPLOSIVES

1.9

Prepared by: ______________________ Date: 3/2/95
J. R. Stine, DX-16

Prepared by: ______________________ Date: 3/3/95
G. Jio, DX-16

Approved by: ______________________ Date: 3-5-95
John C. Dallman, DX-16 Group Leader

Approved by: ______________________ Date: 7/14/95
DX-DO

Approved by: ______________________ Date: 14 Jun 95
ESH-5
EW 7/12/95

Final Approval: ______________________ Date: 9/7/95
M. K. Orbesen, Group DX-16 ES&H Officer

Contents

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1.0 INTRODUCTION

This SOP covers transportation between TA-9 and other TAs accessible without traveling on public roads. Motor vehicle shipments on public highways are governed by Department of Transportation (DOT) regulations and are not addressed in this SOP.

2.0 PURPOSE

This Standard Operating Procedure (SOP) describes the precautions and procedures for safe packaging, repackaging, and on-site transportation operations.

3.0 SCOPE

Only qualified DX-16 personnel may package and repackage explosives coming into or going out of TA-9 and TA-14. These operations may only be performed at TA-9-50 and at TA-14-23 in Rooms 102 and 103. Explosives produced in other buildings at TA-9 can also be packaged in these buildings under this SOP. Repackaging that involves 500 g or less and that is part of normal laboratory operations is covered in other SOPs.

4.0 DEFINITIONS

Box Number: A unique number assigned to any type of container that contains explosives. The Magazine Custodian affixes a label with this number to the container for inventory use.

Cargo Area: Is defined as the wooden box, fixed container, used to transport explosive in.

Hazardous Material Transfer Form (HMTF): Hazardous Material Transfer Form used for transporting between TAs other than TA-9 and TA-14.

5.0 RESPONSIBILITIES

5.1 Group Leader

- Ensures that the necessary policies, procedures, equipment, training, and manpower are available for safe packaging and on-site transportation and delegates the responsibility for implementation of details to a Team Leader.

5.2 Team Leader

- Implements the details for safe packaging and on-site transportation.
- Chooses, along with Group Leader, the Operator.

5.3 Operator

- Is responsible for safe packaging and on-site transportation operations.
- Has a valid New Mexico drivers license.
- Responsible for cleaning of any residual HE and proper disposal.
- Has fire extinguisher training.

5.4 DX-16 Vehicle Maintenance Coordinator

- Requests regular maintenance on DX-16 vehicles.
- Requests as-needed maintenance.
- Visually inspects vehicles and if necessary cleans explosives out of vehicles before they are sent to maintenance.
- Visually inspects and documents on a monthly basis.

5.5 Environment, Safety, and Health (ES&H) Officer

- Documents annual inspection of vehicles.

5.6 DX-DO Training Officer

- Provides information on training for these operations. Training is in accordance with the Laboratory's Administrative Requirements (ARs) in the *Environment, Safety, and Health* Manual and the *DOE Explosives Safety Manual,* Chapter V.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Personnel and Explosive Load Limits

The personnel and explosive load limits shall be the limits that apply to the operation and to the facility where the operation is performed. Personnel and load limits for specific operations in some locations are provided below.

Operation	Location	Personnel Limits	Load Limits
Packaging and Repackaging Explosives	TA-9, Building 50 TA-14, Building 23 Room 103 Room 104	3 operators 3 casuals 2 operators 1 casuals 2 operators 1 casuals	200 lb 50 lb 50 lb
Transporting Explosives	N/A	2[a]	25 kg (55 lb)/vehicle

[a] No person may ride in the cargo compartment with explosives. Second person may only ride in front passenger seat.

6.2 Protective Clothing

The protective clothing needed varies with the type of material involved. Usually protection against inhalation of dust is of primary importance when packaging explosives. The following protective equipment shall be available:

- Face shields
- Surgical-type rubber gloves (to be worn only once and discarded in an explosives-contaminated waste can)
- Leather-palmed, cotton work gloves (to be worn and discarded in an explosives-contaminated waste container when they become contaminated)
- Respirators if indicated by the MSDS (must be approved for the specific hazard by Group ESH-5)
- Safety glasses
- Shoes with no exposed metal on the sole

6.3 Containers

Only containers meeting specifications given in the *DOE Explosives Safety Manual* will be used for packaging, transporting, or storing explosives. These containers include, but are not limited to, plastic sample bottles, fiberboard containers with Velcro closures, fiberboard drums, and ice cream containers.

Explosives received in containers from manufacturers may be stored and transported in those containers, providing the container has DOT approval and meets the requirements in the *DOE Explosives Safety Manual*. This exemption is made to avoid unnecessary handling of explosives.

6.4 Approved Tools

The tools listed below are approved for a particular operation.

Operation	Approved Tools or Equipment
Opening Shipping Containers	Ferrous hand tools: • Knives • Claw hammers • Scissors • Screwdrivers • Wire cutters • Pry bars
Packaging and Repackaging Explosives	The following tools should be made of reasonably strong and resilient material, such as wood, plastic, paperboard, or rubber: • Scoops • Spatulas • Funnels • Brushes **CAUTION** These tools cannot be made of ferrous material.

Continued on next page

Approved Tools - continued

Operation	Approved Tools or Equipment
Transporting Explosives	Only cargo-carrying vehicles, such as pick-ups and vans, that have a separate cargo section or a built-in box for the explosives may be used. Each vehicle shall be equipped with the following: • Explosives placards (plainly visible from all directions) • Anchored box, tie-down bolts, rings, and straps of adequate strength to securely fasten the explosives • Cargo area with no sharp projections • Chock blocks • Rear-view mirrors on both sides of the vehicle • One fire extinguisher inside the vehicle with a minimum rating of 2A:10BC (see Attachment I)

6.5 Precautions During Inclement Weather

If in the judgement of the operator, inclement weather exists, the following precautions shall be followed.

Activity	Precaution
Packaging explosives inside a permanent building that is protected against lightning	May continue activity.
Loading an unprotected vehicle	Must cease activity.
Transporting explosives incidental to the operations of this SOP, either on foot or in vehicles	Must cease activity if hazardous conditions exist, such as an electrical storm, heavy snow, fog, rain, or ice .

6.6 Vehicle Maintenance

All vehicles used to carry explosives shall receive regular maintenance, and they shall be checked annually to see that such things as brakes, brake lights, and windshield wipers are working properly. Documentation of maintenance is kept by GSA. (Refer to DOE Explosives Manual Chapter II-45, 14.1 Subparagraph B.

Drivers should report a vehicle that is not in good operating condition to the DX-16 Vehicle Coordinator, who will see that it is repaired. (Refer to attached memo.)

Before sending a vehicle for maintenance, it must be thoroughly checked for explosives and cleaned if necessary. Explosives removed during cleaning must be disposed of according to Group DX-16:SOP 1.5.

7.0 PROCEDURAL STEPS

7.1 Packaging and Repackaging Explosives

Follow the procedures below when packaging or repackaging explosives.

Step	Action
1	Familiarize yourself with the MSDS that describes the hazards of the material being packaged or transported.
2	Fill out the HMTF (Attachment II)
3	Observe the building load limits when packaging or repackaging operations at TA-9 or TA-14.
4	Use resilient flooring or mats when handling large or awkwardly shaped pieces of explosives.
5	Before placing explosives in any container, • be sure the container is appropriate for the particular explosive, and • check to see that it is clean and in good condition.
6	Include sufficient lining material to assure that the explosive will not move in the container or come in contact with other explosives in the container.

Continued on next page

Packaging and Repackaging Explosives (continued)

Step	Action
7	Transfer consolidated charges to or from the container one charge at a time.
8	Scoop, instead of pour, bulk explosives from the container unless only small quantities are involved. **CAUTION** NEVER scrape the scoop along the sides or the bottom of the container.
9	Pour the last portion of explosive from the container to completely empty it.
10	DO NOT scrape or pound badly caked bulk explosive to loosen it. **Note:** A Special Work Permit (SWP) may be required before proceeding on badly caked explosives.
11	When transferring liquid explosives, normal methods of liquid transfer may be used.
12	Before transferring volatile liquid explosives, such as nitromethane, that are stored in drums to another container, • connect the two containers with a grounding wire and • connect the drum to the building ground.
13	Close the newly loaded container. **CAUTION** DO NOT use undue force when closing the container.

Continued on next page

Packaging and Repackaging Explosives (continued)

Step	Action
14	Plainly mark the container with the contents and the appropriate explosive labeling before removing it to another location. **Note:** If the container will be stored in a magazine, the Magazine Custodian will label it with the unique box number.
15	Weigh the loaded container. **Note:** The container and its contents shall weigh no more than 25 kg (55 lb).
16	Properly close the container that the explosive has been transferred from if it will be returned to storage. **CAUTION** BE SURE the closure is free of loose explosive before closing the container.
17	• Clean loose explosive from empty containers that will be reused, • Secure the lid, • Label the container "empty," and • Store the container.
18	• Empty containers, straps, paper liners, excelsior, or other packing material from TA-9 and TA-14 that will be stored as explosives-contaminated waste in satellite storage areas near point of generation (same building). • Dispose of waste according to DX-16:SOP 1.5.

7.2 Housekeeping

High standards of housekeeping must be maintained in any operation involving explosives.

Step	Action
1	Clean up minor spills immediately. **Note:** Whether a spill is major or minor is a judgment call of the Operator and will depend on a number of factors: amount, location, type of material, etc. The general guideline for a minor spill is one that can be cleaned up safely with the tools available.
2	For major spills or if a Storage Compatibility Group A or L explosive is involved, • notify the spill coordinator, • move all explosives in the vicinity of the spill to a safe place if it can be done without walking through the spilled explosive. • have the spill cleaned up.
3	Sweep up and deposit any loose explosive in the proper waste receptacle at the end of the operation.
4	Hose down the area into an explosives-approved drain if necessary.

7.3 Transporting Explosives

To transport explosives, operators with a valid New Mexico driver's license shall follow the procedures below

Step	Action
1	Turn off the engine and set the brakes when • the explosives are being loaded or unloaded, • the explosive containers are not secured in the cargo area, • the doors of the building or magazine being served are open, • explosives are present in the loading area around the vehicle, • any part of the explosive load is exposed or not protected by its container, or • the cargo compartment door is open.
2	Chock the rear wheels of the explosive-carrying vehicle.
3	Check the cargo compartment before loading the explosive to see that it is clean and contains no loose items such as tools or pieces of metal.
4	Place the explosives in an enclosed compartment or secure them with tie-downs so they are protected from shifting, sliding, tipping, or excessive jarring during normal, expected use of the vehicle.
5	Make sure all personnel are wearing seat belts.
6	Obey all traffic regulations.
7	Drive no more than 25 mph within a particular TA and no more than 35 mph between TAs.
8	Always be alert for joggers, bicycles, and wild animals on or beside the road.
9	Turn off the engine whenever the loaded vehicle will be idle for more than 2 minutes.
10	Do not leave the vehicle unattended when explosives are inside. **Note:** If an explosives-loaded vehicle must be abandoned because of an emergency, follow the procedures in Section 7.5 below.

Step	Action
11	DO NOT add fuel to the vehicle or have maintenance performed while it contains explosives, except for emergency situations.
12	DO NOT open explosive containers while they are in the vehicle.
13	Unload the vehicle.
14	Check to see that no loose explosive material remains after unloading.
Step	Action
15	Clean out any loose explosive material immediately.
16	Dispose of explosive waste according to DX-16:SOP 1.5.

7.4 Disposing of Waste

Waste generated from these operations shall be packaged and disposed of according to DX-16:SOP 1.5. Waste minimization will be handled according to Section 13 of the DX-Division Operations Manual.

7.5 Emergency Procedures

When transporting explosives, circumstances such as mechanical breakdown or a flat tire might require that an explosives-carrying vehicle be temporarily parked beside the road. In such cases, follow the precautions below.

Step	Action
1	Park off the road as far as practical, preferably in a location easily visible from both directions.
2	If parking off the road is not possible, • park where the vehicle can be seen from a distance in both directions and • direct traffic around it.

Step	Action
3	Use emergency flashers if appropriate. **CAUTION** DO NOT carry or use flares.
4	Do not abandon the loaded vehicle unless it is imperative to do so for your safety.
5	Notify the DX-16 Group Office as soon as possible by messenger or radio, and someone there will call for help.
6	Remove the explosives to another properly equipped vehicle before allowing a malfunctioning vehicle to be towed away for repair or before leaving it unattended. These vehicles will be repaired at TA-16.
7	Change a flat tire without unloading the vehicle only if it is parked in a safe position where it will not be hit.

8.0 REQUIRED RECORDS

- MSDS
- HMTF

9.0 REFERENCES

- DOE Explosives Safety Manual
- Los Alamos Environment, Safety, and Health Manual
- DX-Division Operations Manual
- DX-16:SOP 1.5

10.0 ATTACHMENTS

I. Memorandum, HS-5-92-615, "Waiver of DOE Explosives Safety Manual Advisory Standard"

II. HMTF

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Attachment I

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: Distribution

DATE: June 3, 1992

FROM: R. H. Goldie, HS-5

MAIL STOP/TELEPHONE: K489/7-7331

SYMBOL: HS-5-92-615

SUBJECT: **WAIVER OF DOE EXPLOSIVES SAFETY MANUAL ADVISORY STANDARD**

Pursuant to Chapter I, Paragraph 3.2 of the Department of Energy Explosives Safety Manual, a waiver of the advisory standard contained in Chapter II, Paragraph 16.1.2.d (see attached) of that manual is granted. The waiver will allow for vehicles to transport explosives on-site with one fire extinguisher mounted to the vehicle. This is consistent with the requirements of the Department of Transportation and the practice of the U.S. Army.

RHG:seg

Att. a/s

Cy: J. L. Bellows, DOE-AM, w/att., MS A316
R. J. Valdez, DOE, w/att., MS A316
J. B. Ramsay, LANL ERC, w/att., MS J960
G. G. Hill, WX-DO, w/att., MS P945
W. A. Bradley, WX-DO, w/att., MS P945
T. R. Neal, M-DO, w/att., MS P915
D. B. Griechen, M-DO, w/att., MS P915
A. M. Valentine, NWT/OSO, w/att., MS C918
HS-5/OS Reading File, w/att., MS K489
CRM-4, w/att., MS A150

RHG92005.MSW

EXPLOSIVES SAFETY WAIVER

A waiver is granted for conditions described below that do not conform with the advisory standards set forth in the DOE Explosives Safety Manual, DOE/EV/06194-6.

I. Applicable paragraph of DOE/EV/06194-6

Chapter II, Paragraph 16.1.2.d

II. Provision of DOE/EV/06194-6 not being met

Two fire extinguishers with a minimum rating of 2A:10BC, one of which should be mounted outside the vehicle.

III. Discussion

Los Alamos National Laboratory uses vehicles provided by GSA. A recent change in GSA policy requires that an exorbitant fee be paid to alter their vehicles by mounting equipment, such as fire extinguishers, on their exterior. On site movements of explosives are done under controlled conditions at reduced speeds, by qualified drivers, and are well within the response range of the Los Alamos County Fire Department. Further, fire extinguishers mounted to the exterior of vehicle frequently become unserviceable or are found missing. A single properly maintained fire extinguisher rated at least 2A:10BC is adequate for an explosives laden vehicle as fires, other than a minor ones away from the cargo area, will be fled from and not fought.

The use of a single fire extinguisher on explosives laden vehicles conforms to the requirements of the Department of Transportation and the U. S. Army.

IV. Conditions of Waiver

A single fire extinguisher, with a rating of at least 2A:10BC, will be mounted inside the drivers compartment of all vehicles transporting explosives on-site. A second fire extinguisher may be mounted in or on the vehicle at the discretion of the operating group.

V. Terms of Waiver

No corrective actions are proposed or deemed necessary; this waiver will expire three years from the date of signing (May 1995) unless renewed.

J. O. Jackson	G. G. Hill	T. R. Neal
HS-DO	WX-DO	M-DO

LOS ALAMOS
NATIONAL LABORATORY

HAZARDOUS MATERIALS TRANSFER
(Other Than Radioactive)

HM No.	SM No.	Date

GENERAL INSTRUCTIONS: This form is an official shipping document for transporting hazardous material within LANL boundaries. Type or print all entries. Material Safety Data Sheets (*MSDS*) and appropriate Emergency Response Guide information must be attached to this document. Distribution of completed forms is indicated below.

FROM					
Name					
Telephone	Group	TA	Building	Room	

TO					
Name					
Telephone	Group	TA	Building	Room	

Item	No. of Pkgs.	Proper Shipping Name	Hazard Class and Division	UN/NA Number	Packing Group	Net Qty. Wt./Vol.
Item A						
Additional Description			Gross Weight	Required Labels	Required Placards	
Packaging Used		Packaged By	Z Number	Date		
Item B						
Additional Description			Gross Weight	Required Labels	Required Placards	
Packaging Used		Packaged By	Z Number	Date		
Item C						
Additional Description			Gross Weight	Required Labels	Required Placards	
Packaging Used		Packaged By	Z Number	Date		

Item A	Cost Code/Program Code	Item B	Cost Code/Program Code	Item C	Cost Code/Program Code

EMERGENCY RESPONSE TELEPHONE NUMBER: (505) 667-6211

EMERGENCY CONTACT TELEPHONE NUMBERS FOR INTRA-LABORATORY TRANSFERS

Name	Z Number	Group	Telephone Number	Emergency Response Guide Number(s)
				Item A_____ Item C_____
Name	Z Number	Group	Telephone Number	Item B_____

SHIPPER'S CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper (*Signature*)	Z Number	Mail Stop	Date

ADDITIONAL TRANSPORTATION INFORMATION

Driver/Transporter	Z Number	Transport Vehicle License Tag Number	
Estimated Date and Time of Arrival	Material Received By	Z Number	Date/Time

Form 1468 (6/93)

ST505

Los Alamos
NATIONAL LABORATORY
memorandum

EXPLOSIVES TECHNOLOGY & SAFETY
DX-16

To/MS: DX-16 Personnel
Thru: J. C. Dallman, DX-16, C920
From/MS: K. A. Firestone, DX-16, C920
Phone/FAX: (505)665-7087(505)667-0500
Symbol: DX-16-94-253
Date: 8/12/94

Disassembly/Disposal/Transfer/Maintenance of Property from DX-16

We are a group with a long history and a lot of historical equipment. The guidelines of the past no longer fit the actions of the present. It is imperative that we follow the guidelines of today when disassembling old equipment, or the salvage and disposal of property. These are guidelines to help in this process.

1. If you are unsure about what is required, ask the ES&H Officer.

2. All items to be salvage or disposed of **must** be monitored by an RCT, even if it goes in the dumpster. The RCT will place a tag, with a number that corresponds with a line item number on an Equipment/Material Pick-up/Transfer (EMPT), on each item . Once the monitoring is complete, boxes will be closed and **sealed** to prevent any addition of unmonitored items. In cases where the equipment was used in or around HE operations, a visual inspection followed by an HE Spot test must be done before leaving the site.

3. All vehicles must be washed, vacuumed, HE Spot tested and monitored by an RCT before being turned over to the GSA Motorpool or salvage.
   a. The only exception to this will be routine maintenance done on vehicles, when maintenance is completed at the S-Site garage. To arrange for maintenance at S-Site, contact Bill McCormick, ESA-12, 667-6316.

4. Equipment being dismantled, that has suspect contamination, must have an RCT on-site **before** work is begun. A Radiological Work Permit (RWP) must be filled out and signed prior to dismantlement. See AR 1-3 for more information. *If you do not know then this procedure is automatic no matter what.*

5. If you are transferring items from a posted contaminated area, you must have them monitored by an RCT before transporting. An example would be the transfer of equipment from TA-14, Q-Site West to any other area.

Distribution:
DX-16 Personnel
DX-16 ES&H File
DX-16 File

Los Alamos
NATIONAL LABORATORY
memorandum

EXPLOSIVES TECHNOLOGY & SAFETY
DX-16

To/MS: Distribution
Thru: J. C. Dallman, DX-16, C920
om/MS: K. A. Firestone, DX-16, C920
ne/FAX: (505)665-7087(505)667-0500
Symbol: DX-16-94-
Date: 8/9/94

EXCESS VEHICLE POLICY - CLEAN-UP REQUIREMENTS

Before any vehicle leaves DX-16 to be excessed it must be put through the following clean-up procedures:

1. Washed
2. Vacuumed inside passenger area and the bed of any truck.
3. An HE spot test must be performed on all vehicles going to salvage or GSA.
4. An Radiological Control Technician (RCT) must be called to monitor all vehicles that are being returned to salvage or GSA. A tag must be placed on the vehicle stating it has been monitored and is clean.

Distribution:
All DX-16 Personnel
ES&H File
DX-16 File

Memo to: M. Orbesen, DX-16, MS C920 1 June 1995

From: R. Goldie, ESH-5, MS K403

Subj: Renewal of Waiver

The Laboratory currently waives a provision of the Department of Energy Explosives Safety Manual, Chapter II, Paragraph 16.1.2.d requiring two fire extinguishers for vehicles transporting explosives (Class 1 materials) on-site. This waiver was originated in 1992 and is due to expire in May 1995 as a result of it having been in place for three years. In that the waiver is required on a continuing basis, it is now being renewed for another three years; this is the maximum time allowed by DOE.

We will provide you a copy of the waiver renewal once it's signed by the ESH Division Office.

Cy: K. Firestone, DX-DO, MS P915
R. Rowan, ESA-WMA, MS C930

Los Alamos
NATIONAL LABORATORY
memorandum
Environment, Safety, and Health Division

To/MS: Distribution
From/MS: Dennis J. Erickson, ESH-DO, MS K491 DJE
Phone/FAX: 7-4218 / 5-3811
Symbol: ESH-DO:95-447
Date: July 11, 1995

Subject: **Update of Waiver to DOE Explosives Safety Manual Advisory Standard**

The attached waiver was initially issued in June 1992, and was to expire in 1995. The waiver is still required by Los Alamos National Laboratory operating groups and is updated for a period of three years in accordance with the provisions of DOE Explosives Safety Manual (DOE/EV/06194-7), Chapt I, Paragraph 3.2. The revised expiration date is July 1998.

This waiver will allow properly equipped vehicles with qualified operators to transport explosives on-site with a single fire extinguisher. This waiver is predicated on the assumption that on-site transport is well within the rapid response time of the Los Alamos County Fire Department which provides a level of protection greatly exceeding that of an additional fire extinguisher.

Attachment: a/s

DJE:FB:dts

Distribution
DOE/LAAO-AM, MS A316
DOE/LAAO-ES&H, MS A316
R. H. Day, DD-DX, MS P915
K. A. Firestone, DD-DX, MS P915
R. J. Burick, DD-ESA, MS P945
M. MacRoberts, DD-ESA, MS P945
R. A. Lucht, DX-16/ERC, MS C920
B. C. Hargis, ESH-5, MS K486
F. N. Bolton, ESH-5, MS K403
R. H. Goldie, ESH-5, MS K403
P. D. Whitehead, ESH-5, MS K403
ESH-5/OSS Reading File, MS K403
ESH-DO File, MS K491

EXPLOSIVES SAFETY WAIVER

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I. Applicable paragraph of DOE/EV/06194-6

Chapter II, Paragraph 16.1.2.d

II. Provision of DOE/EV/06194-6 not being met

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III. Discussion

Los Alamos National Laboratory uses vehicles provided by GSA. A recent change in GSA policy requires that an exorbitant fee be paid to alter their vehicles by mounting equipment, such as fire extinguishers, on their exterior. On site movements of explosives are done under controlled conditions at reduced speeds, by qualified drivers, and are well within the response range of the Los Alamos County Fire Department. Further, fire extinguishers mounted to the exterior of vehicle frequently become unserviceable or are found missing. A single properly maintained fire extinguisher rated at least 2A:10BC is adequate for an explosives laden vehicle as fires, other than a minor ones away from the cargo area, will be fled from and not fought.

The use of a single fire extinguisher on explosives laden vehicles conforms to the requirements of the Department of Transportation and the U. S. Army.

IV. Conditions of Waiver

A single fire extinguisher, with a rating of at least 2A:10BC, will be mounted inside the drivers compartment of all vehicles transporting explosives on-site. A second fire extinguisher may be mounted in or on the vehicle at the discretion of the operating group.

V. Terms of Waiver

No corrective actions are proposed or deemed necessary; this waiver will expire three years from the date of signing (May 1995) unless renewed.

Ronald H. Stafford	G. G. Hill	T. Neal
J. O. Jackson	G. G. Hill	T. R. Neal
HS-DO	WX-DO	M-DO

STANDARD OPERATING PROCEDURE

FOR

DISPOSAL OF EXPLOSIVE WASTE AND EXPLOSIVE-CONTAMINATED WASTE

SOP M-8-17

Because of the transition from M-4 and M-8 to DX-11, this SOP has been reviewed by DX-11 personnel and is issued without changes for operations at TA-36.

Next Review Date: August 1995

Approved by: C. M. Mott Date: 9-27-94
DX-11

Approved by: Diane Brucker Date: 9/27/94
DX-DO

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

SPECIAL WORK PERMIT FOR POTENTIALLY HAZARDOUS ACTIVITIES

Requested by	Organization	Issue Date	Expiration Date
Bruce E. Takala	DX-11	Sept. 23, 1994	Sept 1, 1995

Location of Work (Tech Area, Building, Room Number)	SWP I.D. Number
TA-36-8, -12, -103	SWP-DX-11-94-20

Work to be Performed

Disposal of explosive waste and explosive-contaminated waste.

Extend operations of SOP M-8-17, "Disposal of Explosive Waste and Explosive-Contaminated Waste" to Sept. 1, 1995

Identified Hazards

Handling explosive waste and explosive-contaminated waste.

PERSONNEL ASSIGNED

Name	Duties
See attached distribution list	

SPECIAL CONTROLS

Safety Measures, Precautions, Personal Protective Equipment, Procedures, etc.

See attached SOP.

APPROVED BY

		Organization	Date
Group Leader Allan B. Anderson, Group Leader	for P. M. Norton DX-11	DX-11	9/26/94
Safety Officer Bruce E. Takala, Safety Officer	Bruce Takala	DX-11	9/27/94
Supervisor		DX-11	
Others Diane Griechen, ES&H Officer	Diane Griechen	DX-DO	9/27/94
Roger Goldie, Safety Engineer	Roger Goldie	ESH-5	9/27/94

STANDARD OPERATING PROCEDURE

FOR

DISPOSAL OF EXPLOSIVE WASTE AND EXPLOSIVE-CONTAMINATED WASTE

Prepared by:	C. M. Montoya	Date:	1-22-93
Approved (M-8):	J. W. Straight	Date:	1/22/93
Approved (M-DO):	T. R. Neal 1/22/93	Date:	1-22-93
Approved (EM-8):	J. M. Dewart	Date:	1/27/93
Approved (HS-5):	R. H. Goldie	Date:	
Implementation:	C. M. Montoya, M-8 ES&H Chairman	Date:	1-29-93

This SOP has been approved by M-8 and M-DO. While we await final approval from groups in HS or other divisions, we are using the SOP as a completely legitimate instrument. If more than 30 days has elapsed without action by reviewing groups outside M Division, the SOP will be regarded by the M-8 Group Office as having the full force of complete and unqualified endorsement.

1.0 INTRODUCTION

Explosive waste and explosive-contaminated waste are generated as a result of M-8 firing-site operations involving high explosives (HE). A small percentage of the tests conducted by M-8 contain depleted-uranium (DU) components. M-8 may also be requested to dispose of explosive waste from other LANL groups, such as WX-3. Within this document, the materials are defined that comprise explosive waste and explosive-contaminated waste, and procedures are described for their disposal. This SOP governs the activities of all M-8 employees and the Johnson Control (JCI) employee working routinely with Group M-8, in regard to the handling and disposal of explosive waste and potentially explosive-contaminated waste for all M-8 explosives operations. The *DOE Explosives Safety Manual*, LANL ES&H requirements, and appropriate M-8 SOPs are the primary reference documents.

2.0 DEFINITIONS

Explosive waste is identifiable pieces of explosives that are either *excess explosive* or *scrap explosive*.

Excess explosive is identifiable pieces of explosive resulting from assembly operations or from explosive material that is no longer needed for programmatic reasons (and about which a decision has been made to remove it from inventory). This retains its original explosive storage compatibility classification.

Scrap explosive is identifiable pieces of explosive that have been damaged or potentially altered as a result of a misfire or incomplete detonation, or that result from severe test environments.

Potentially explosive-contaminated waste involves tools, objects, and materials used directly with explosives or used in charge preparation rooms or explosives magazines, or it can be *firing-mound debris*. In some cases, this must be destroyed *in situ* because of overriding safety considerations.

Firing-mound debris is material that results from energetic materials tests done by M-8. These materials are potentially contaminated by HE. Firing-site debris can be further divided into the following types.

Type ①: wood scraps, cardboard, burlap, and Plexiglas/Lexan.

Type ②: material such as plastic, glass, styrofoams, electrical cables, and metallic foils used for pin switches

Type ③: metals, such as steel target plates.

TA-36-8 *destruct area* is located at Minie Site. It operates under interim status for treatment by open detonation of explosive waste, in accordance with the standards in Los Alamos National Laboratory's RCRA, Part B Permit Application.

TA-36-12 *burn area*, located at Lower Slobbovia Firing Site, is approved and has been issued a permit by the New Mexico Environment Department (NMED), formerly known as the Environmental Improvement Division (EID), for burning potentially HE-contaminated wood scraps, cardboard, and burlap.

TA-36-12. Area II. is located at Lower Slobbovia Firing Site. Type ② firing-site debris material will be collected and placed in this area.

TA-36-103. Area III is located outside at Dogpatch Site, which is adjacent to Potrillo Drive between the turnoff to Meenie and Minie Firing Sites and the turnoff to the main magazines (ProMoe, Moe, and DetMoe). Type ③ firing-site debris will be collected and stored at this location awaiting final disposition.

Completed burn is when the fire has extinguished itself to the point it is no longer a fire hazard. The Group Leader or Safety Officer make this determination.

3.0 RESPONSIBILITIES

3.1 Site Supervisor

Under the direction of the technical staff member or senior technician supervisor in charge, he is responsible for ensuring that firing-mound debris generated at his particular site is sorted, collected, and placed in the proper area or areas.

3.2 Group Waste Management Coordinator

This individual is available to assist M-8 personnel in determining how the material should be sorted, what area it should be placed in, and what the particular packaging and transportation requirements are to be used.

3.3 Group Leader or Safety Officer

These individuals will determine whether the explosive scrap presents a hazard and what the method of disposal should be, if any questions arise. They will also determine when a burn is completed.

3.4 Qualified Personnel

All M-8 operators (as defined in the M-8 Safety Charter) are qualified. A JCI employee routinely supplied to M-8 as a firing-site mound cleanup person is part of the normal operations and he is in the category of "knowledgeable visitor," which is also defined in the Safety Charter. The JCI employee is allowed to clean up the firing mound and transport debris from the firing mound to the appropriate collection area.

3.5 HE Inventory Coordinator

This individual is responsible for ensuring that HE and HE-contaminated materials sent to WX-3 for incineration are labeled and packaged properly, and that the appropriate documentation has been completed and sent with the materials.

4.0 HAZARDS

Identifiable hazards include the following: Handling and transport of HE and of other materials inseparable from or partially covered with high explosives.

Some explosive tests contain DU material and thus are potentially tainted with HE and/or DU contamination.

Heavy materials include steel plates ≥ 50 lbs.

5.0 PROCEDURES

5.1 Make-Up Room Wastes

Each make-up room has a Hazardous Waste satellite storage area. Explosive-contaminated waste, such as paper towels, swabs, and similar materials that contain no tangible pieces of explosive but are used in the preparation of shots in the make-up building, should be placed in a paper-lined cardboard box with a lid. A separate box for bits, pieces, and small chunks of excess explosive may also be stored at the satellite storage area for disposal at WX-3 by incineration or for detonation at TA-36-8 Minie Site destruct firing area. The paper liner in the boxes shall be closed and sealed with tape and transferred to a box sealed and labeled with the words "Explosive Hazardous Waste." If the boxes are to be transported to WX-3 for incineration, contact the M-8 HE Inventory Coordinator to ensure that the material is properly packaged and the Hazardous Material Transfer form has been properly completed. This material shall not be allowed to accumulate beyond a collective volume of the equivalent of a 55-gal drum. Refer any question to the M-8 Waste Coordinator.

5.2 Scrap Explosive Assemblies and Explosive to be Delivered to Other Groups Only if Authorized

If a group requests that their assembly be returned for their own examination, they must first receive proper authorization. After the authorization has been given, the responsible M-8 individual shall present the problem to the M-8 Safety Officer, who will work through the HE Inventory Coordinator. The HE Inventory Coordinator will arrange with the appropriate person in WX-3 for specific instructions on marking, packaging, and transportation to the receiving group. WX-3 is responsible for transporting explosive off-site onto public roads. If the material is sent to WX-3, it will be packaged and labeled according to hazardous materials packaging and transportation requirements. A Hazardous Material Transfer form shall be filled out by M-8 personnel to accompany the materials when they are transported on public roads to WX-3. The Group Leader or Safety Officer is responsible for determining that the explosive or explosive assembly presents no unusual hazard.

5.3 Scrap Explosive Assemblies and Explosives Unsafe to Handle

When a damaged explosive assembly or explosive on the firing mound is believed to be unsafe to transport or handle, it will be disposed of by detonation on the firing mound or by flash burning the assembly. The disposal method shall be approved by the Group Leader or the Safety Officer. Any heavy metals or foams containing toxic materials that become airborne during burning or detonation are quantified and reported in the monthly materials expended summaries to M-DO and EM-8.

5.4 **Identifiable Scrap Explosive that is Safe to Handle**

Scrap explosive is essentially damaged explosive and is defined as identifiable explosive pieces resulting from a misfire, an incomplete detonation, or an exposure to severe testing.

Pieces of explosive sufficiently large to be identified, whether resulting from a misfire, sensitivity experiment, incomplete detonation, or severe testing shall be collected in paper bags. Damaged explosive shall be collected separately from excess explosive. The maximum weight of material in one bag will be 110 g ($\approx ^1/_4$ lb), subject to the hazard level of the material. Paper bags containing the explosive will be placed in cardboard boxes. Individual pieces larger than 2.5 by 2.5 by 2.5 cm ($\approx$1 cu. in.) shall be wrapped before being placed in the box to prevent rubbing during handling and transportation. Except when an individual piece is too large, the maximum weight of material in one box shall be limited to 12 kg. The box shall be sealed with tape to prevent escape of small fragments and shall be labeled with the words "Hazardous Waste." Pieces larger than 15 kg shall be destroyed in place. This weight limit shall be reduced if, in the opinion of the Firing-Site Leader or the M-8 Safety Officer, this large a quantity would create a hazard.

Unless the explosive scrap or damaged explosive is to be delivered to another group, as covered in Sec. 5.2, and if the scrap or damaged explosive is safe to handle, the scrap or damaged explosive shall be destroyed by detonation in the destruct firing area at TA-36-8 using a sufficiently large charge to ensure complete destruction of the scrap. TA-36-8 operates under interim status for treatment by open detonation. (This shall be carried out as described in SOP M-8-5.) Scrap or damaged explosive shall be destroyed as soon after its creation as possible.

When scrap explosive is generated as a result of a misfire or incomplete detonation of a charge on a firing mound, the Firing-Site Leader shall thoroughly search the firing mound and collect all identifiable pieces of explosive. The damaged explosive shall be weighed and an estimate of the amount of material remaining on the mound recorded in the Site Record Log Book. Every effort shall be made to minimize the quantity remaining on the mound.

Also, when damaged explosive is generated, tangible quantities of very small particulate explosives may remain in the firing area after the cleanup. At the discretion of the Site Leader and with the concurrence of the Group Leader, the firing area may be burned with a propane weed burner to complete the cleanup process. A burn permit is required for this operation.

5.5 **Identifiable Booster Charge Scrap**

When possible, booster explosive like PETN and XTX shall be packaged in separate containers from materials listed in Sec. 5.4 and labeled as "Hazardous Waste." The contents of a box shall be clearly identified. Boxes shall be disposed of as described in Sec. 5.3, if it is unsafe to handle, or in Sec. 5.4, if it is safe to handle.

5.6 Firing-Mound Debris

Before any firing-mound debris is collected for disposal, the Firing-Site Supervisor will ensure that the firing mound is examined for explosive scrap. Scrap explosive shall be handled appropriately (see Secs. 5.2–5.4). This operation shall be carried out before JCI personnel are allowed on the mound, as covered in the following section.

Firing-site debris from firing operations shall be cleaned up either by M-8 personnel or by a JCI cleanup person (or both). This debris shall be transported and placed in the appropriate areas, depending on the type of material (see Sec. 2.0).

Heavy materials such as steel plates $\geq$ 50 lbs should not be lifted manually by individual M-8 operators and employees. Personnel should utilize the proper lifting equipment or seek assistance, if materials are too bulky or cannot be reasonably handled by one person.

5.6.1 Burning Operation at Burn Area (Type ① Material)

The burn area, which is located near TA-36-12 at Lower Slobbovia, is permitted only for wood, cardboard, burlap sandbags, and small amounts of Plexiglass/Lexan (an acrylic material).

M-8 is permitted to burn identifiable wood scraps, cardboard, burlap from the sandbags, and Plexiglass or Lexan used in shots because they can be contaminated with HE. We are not permitted to burn other plastic and metal, even though they may be contaminated by HE.

The burn area shall be marked with a sign. Access shall be controlled by the Firing-Site Supervisor at TA-36-12 (Lower Slobbovia).

5.6.1.1 Burn Permits. An open burn permit will be obtained annually through EM-8 from the NMED. The Group Leader or his designee shall contact EM-8 to request permission to burn five or more days in advance of the expected burn date.

5.6.1.2 Notification Memo. In advance, the M-8 Safety Officer will send a memo of notification indicating the date, time, and place of the controlled burn to the following personnel:

1. HS-5 safety engineer assigned to TA-36
2. EM-8 Air-Meteorology section leader and coordinator
3. EMO (Emergency Management Office)
4. PA-1 (Public Information Group Leader)
5. Fire Department

5.6.1.3 Fire Department Notification. The Fire Department will be notified again, by telephone, one or more working days in advance of the burn date (date, approximate time of ignition, approximate length of time of burn, and location).

5.6.1.4 Area Control. The safety gate at the entrance to TA-36-12 will be closed and the area will be controlled by the Lower Slobbovia Firing-Site Supervisor. In addition, the safety chain at the entrance to the road that services the burn area and the sled track will be closed. The entire procedure for burning will be continually monitored by M-8 personnel.

5.6.1.5 Debris Ignition. The firing-site debris will be ignited 3 hours after sunrise, in accordance with NMED requirements.

The Group Leader will determine what ignition fuel or combination of ignition fuel will be used. Paper and/or Kimwipes® with diesel fuel or kerosene will be used to aid in the ignition of the wood. No more than 10 gal of diesel or kerosene will be used. A weed burner or matches will be used to ignite the paper and wood. Only M-8 personnel knowledgeable in explosives operations will be allowed to ignite the pile. Fire Department personnel will be present while the debris is being ignited but they will be located at a safe distance specified by the site supervisor. Firefighters will remain on site until the Fire Department supervisor at the scene determines that they may safely leave the burning material to be watched by our personnel. The Firing-Site Supervisor will determine the location where the Fire Department truck will park. This is usually near the TA-36-12 firing chamber at Lower Slobbovia, which is a safe distance from the burn area. Fire Department personnel will remain on site until the Fire Department supervisor on site determines that their service is no longer required. He will notify the firing-site supervisor before leaving the area.

5.6.1.6 Burn Completion. The Group Leader or Safety Officer will make the determination when the burn is completed.

5.6.1.7 After-Hours Control. If the burn has not been completed at the end of the workday, a minimum of two M-8 employees (knowledgeable in explosive operations) will remain on site until the burn has been completed.

If the burn is not complete, the Fire Department (7-4055), Station 100 (LANL Security Force Communications Center) (7-4673), and the M-Division Office (7-5653) must be notified before the end of the workday, that M-8 personnel will be present through the night to monitor burning debris.

When the burn is complete, the M-Division Office will be notified during normal working hours.

5.6.1.8 Ash and Residue Disposal. The Group Leader will determine when the remaining ash and residue will be collected and sent to the proper waste disposal site at TA-54 with the proper documentation, after the residue is monitored by HS-1 personnel for radioactivity.

5.6.2 Area II (Type ② Materials)

All firing-site debris Type ② material will be collected and placed in Area II. Type ② materials that are not DU contaminated may be sent to WX-3 for incineration or flash burning. The Waste Management Coordinator will be responsible for coordinating the activities between M-8 and WX-3. Type ② materials that have no explosive contamination may be sent to an EM-7 waste disposal site after HS-1 has monitored the material and the proper forms and documentation have been generated for transportation and disposal. There is a dumpster labeled for radioactive materials located at Area II, and Type ② materials that are suspected to be DU contaminated are placed in the dumpster. The dumpster must be lined with plastic before any cables or materials are placed inside. A copy of a Waste Profile Request form must be on file for Type ② materials before they can be transported for disposal. See Attachment 1 for Disposal Checklist requirements.

5.6.3 Area III (Type ③ Material)

All firing-site debris Type ③ material will be collected and placed in Area III.

To dispose of Type ③ material, the following must be complete.

1. A Waste Profile Request form must be on file for the Type ③ material.
2. A Radioactive Solid Waste Disposal Request must be completed.
3. A Hazardous Material Transfer form must also be completed.

See Attachment 1 for low-level waste disposal requirements.

5.7 Transportation

5.7.1 Vehicle

The bed of the pickup truck used for transporting material to the burn area shall have no joints or cracks but must be of single-piece construction.

5.7.2 Documentation

WX-3 is responsible for transporting explosives off-site onto public roads. A Hazardous Material Transfer form shall be filled out by M-8 to accompany the transported materials on the public road to WX-3.

5.7.3 Transfer and/or Disposal of Contaminated Equipment from TA-36 Explosives Areas

Tools or objects used directly with explosives or used in charge preparation rooms or explosives magazines shall be decontaminated before they are taken into nonexplosives areas or before any repairs are made to them in an explosives-handling area. Any hazardous waste generated during the decontamination process will be packaged, labeled, and transported as "Hazardous Waste," as directed by AR 10-3.

Some tools and other objects are used in the explosives-handling areas of TA-36 but are not used in explosives magazines or charge preparation rooms; some tools and objects are used on the firing mounds but are not used directly on explosives, nor do they contain residue from explosives. These tools may be taken, at the discretion of the group personnel, into any building or room of TA-36 that is not used for the handling or storage of explosives. Items that can be certified as uncontaminated may be sent to Johnson Control salvage or may be buried in the county landfill after being monitored by HS-1 personnel to confirm the lack of radioactive contamination. Radioactive materials shall be packaged and transported to the TA-54 low-level waste landfill for burial after HS-1 personnel monitor them, as directed by AR 10-2 in the LANL *Environment, Safety and Health* manual. Ambiguities in the classification of items shall be resolved, if possible, by the Safety Officer, along with the site personnel and the staff member in charge of the shot. If doubts remain about the suitability of sending something off-site to be buried, it shall remain at TA-36.

Removal of photographic equipment from explosives-handling areas of TA-36 is described in SOP M-8-9.

Movement of the vehicles assigned to M-8 in and out of the TA-36 area is covered in SOP M-8-1.

6.0 REQUIRED RECORDS

From M-8 shot records, a monthly materials expended report is generated and sent to the M-Division Office. The NMED burn permit is current. Copies are kept of the completed Hazardous Material Transfer forms, the Waste Profile forms for each type of material waste, and the Radioactive Solid Waste Disposal requests. The inspection record form (IRF) is filled out daily by the Minie Firing-Site Supervisor, who hands it in weekly (a copy of each weekly report is sent to EM-8).

7.0 REFERENCES

DOE Explosives Safety Manual, EV/06194, Revision 6, October 1991.

Administrative Requirement (AR) 6-6, "Explosives Disposal," Los Alamos *Environment, Safety, and Health* manual (1992).

AR 10-2, "Low-Level Solid Waste," Los Alamos *Environment, Safety, and Health* manual (1992).

AR 10-3, "Chemical, Hazardous, and Mixed Waste," Los Alamos *Environment, Safety, and Health* manual (1992).

Los Alamos National Laboratory Director's Policy 101, *ES&H Operating Policy* (September 1991).

Los Alamos National Laboratory Director's Policy 102, *Formality of Operations* (September 1991).

<u>M-8 Standard Operating Procedures</u>
M-8-SC: M-8 Safety Charter
M-8-1: Shipping, Receiving, and Transporting of Explosives
M-8-3: Operation of Charge Preparation Rooms
M-8-4: Firing-Mound Operations
M-8-5: Firing Operations
M-8-6: Detonator Magazine Operations
M-8-89: Handling of Depleted-Uranium Components
RCRA Part B Permit Application

8.0 ATTACHMENTS

1. Low-Level Waste Disposal checklist.
2. Inspection Record Form

LLW DISPOSAL CHECKLIST Revision 0) 07/11/91
TA-54 AREA G
RSWD Number ______________

INSPECTION SEQUENCE (this checklist must be completed BEFORE accepting waste)

1. Check load for required documentation
2. Verify that all forms are completed properly
3. Verify radionuclide data using Oracle screening program
4. Physically inspect load to verify matches documentation and meets WAC
5. If all WAC met, accept and properly dispose waste

CHECKLIST

FORMS:

- ☐ SCALE SLIP
  - ☐ Truck was weighed
  - ☐ ID on slip matches ID of truck
  - ☐ Clerk's initials on slip
- ☐ WASTE PROFILE REQUEST FORM (WPRF)
  - ☐ Waste description matches waste (observed)
  - ☐ No RCRA hazard codes on WPRF
  - ☐ Form signed by generator
  - ☐ WPRF number assigned by HSE-8
  - ☐ Form signed by HSE-8 reviewer
  - ☐ Form less than one year old
  - ☐ Low-level radioactive waste box checked
- ☐ RADIOACTIVE SOLID WASTE DISPOSAL REQUEST (RSWD)
  - ☐ Current form
  - ☐ Description matches waste (observed)
  - ☐ Description does not describe liquids, gasses, or powders
  - ☐ Number and type of containers appears correct
  - ☐ Waste code is supplied and appears appropriate
  - ☐ If waste code starts with "A", then radionuclide amount in curies or grams is indicated; if "S", radionuclide is identified but no amount indicated.
  - ☐ Rad data screened by Oracle screening program - is low level, not TRU or GTCC
  - ☐ All generator identification information was supplied on form
  - ☐ Generator signed form
  - ☐ HSE-1, 10, 11 signed form
- ☐ HAZARDOUS MATERIAL TRANSFER FORM (HMTF)
  - ☐ Form is present in manifest package

PACKAGING

- ☐ Dumpsters
  - ☐ Dumpster door opened for inspection
  - ☐ All waste packaged or wrapped
  - ☐ Waste appears to meet WAC (no drums, gas cylinders, oil soaked boxes, etc)
  - ☐ Visible boxes appear to be properly labeled
  - ☐ Compactible/non-compactible not apparently mixed in dumpster
  - ☐ Dumpsters locked properly
  - ☐ Dumpster labels and stenciling present and readible
- ☐ Trucks
  - ☐ Waste in containers (boxes, bags, drums, etc) or wrapped in plastic
  - ☐ Containers in good condition and sealed appropriately
  - ☐ Waste appears to meet WAC (no gas cylinders, free liquids, powders, etc)
  - ☐ Visible PN Numbers verified

HSE-7 Receiving Technician: ______________________ Date: ____________

HAZARDOUS WASTE FACILITY INSPECTION RECORD FORM

FACILITY: TA-36

2 [ ] <90 DAY, GENERATOR STORAGE
[X] TREATMENT, STORAGE, DISPOSAL

START DATE

END DATE

[ ] Containers [ ] Landfill [ ] Surface impoundment [ ] Waste Pile [X] Thermal Treatment [ ] Chem/Phys/Bio. Treat.

[ ] Incinerator [X] Misc. Unit [ ] Tank [ ] UST [ ] Land Treatment [ ] Underground inj.

PART I - Enter condition of item inspected (OK or AR*) in column for day inspected.

ITEM	INSPECTED FOR	SUN	MON	TUE	WED	THU	FRI	SAT
6 NO USE	CHECK IF NO WASTE IS PRESENT							
7 UNLOADING AREA TANKS/CONTAINERS	SPILLS AND DETERIORATION							
8 COMMUNICATION EQUIPMENT (PHONE/RADIO/ALARMS)	PROPERLY FUNCTIONING							
9 TANKS (ALL ABOVE GROUND PORTIONS) MONITORING DATA	DISCHARGE CONTROLS CONDITION, LEAKS, LEVEL (6" FREEBOARD), CORROSION		N/A	N/A	N/A	N/A	N/A	
10 SURFACE IMPOUNDMENTS AND CONTAINMENT	FREEBOARD (2 ft) SUDDEN DROPS IN LEVEL		N/A	N/A	N/A	N/A	N/A	
11 PORTA BERM	LEAKS CONDITION		N/A	N/A	N/A	N/A	N/A	
12 EYE WASH SAFETY SHOWERS	LEAKS, FUNCTIONING		N/A	N/A	N/A	N/A	N/A	
13 STRUCTURAL INTEGRITY OF CONTAINERS/TANKS, VALVES, PIPES, AND FLANGES	DETERIORATION AND LEAKS, CORROSION, DAMAGE							
14 COVER/LID OF CONTAINERS	CLOSED AND SECURED							
15 WARNING SIGNS	POSTED & READABLE (BILINGUAL)							
16 LABELS	"HAZARDOUS WASTE" PRESENT ON ALL CONTAINERS/TANKS							
17 ACCUMULATION START DATE (<90 DAY STORAGE)	PRESENT ON ALL CONTAINERS, TANKS, NONE EXCEED 90 DAYS		N/A	N/A	N/A	N/A	N/A	
18 RUN ON/OFF CONTROL (AREA L, G, H, P) LANDFILLS, DETONATION PADS	INTEGRITY, EROSION PONDING							
19 COVER INTEGRITY (AREA L, G, H, P) LANDFILLS	EROSION, SUBSIDENCE WATER INTRUSION		N/A	N/A	N/A	N/A	N/A	
20 SECURITY	CONDITION, FENCE/GATES/LOCKS							
21 SITE LIGHTING	FUNCTIONS PROPERLY							

ITEM	INSPECTED FOR	SUN	MON	TUE	WED	THU	FRI	SAT
22 CONTAINMENT STRUCTURES	INTEGRITY, STANDING WATER VEGETATION, EROSION							
23 MANAGEMENT OF CONTAINERS.	SEGREGATED ACCORDING TO COMPATIBILITY, 2 FT AISLE SPACE							
24 HOSE BIBS, WATER SUPPLY	LEAKS, FUNCTIONING		N/A	N/A	N/A	N/A	N/A	
25 STORAGE SHED (AREA L)	FLOOR DAMAGE, LIQUID		N/A	N/A	N/A	N/A	N/A	
26 ROAD/WORK SURFACES	CRACKS/POTHOLES							
27 WIND SOCK	DAMAGE, FUNCTIONING							
28 SHAFT COVER AND RAIL	PRESENT, DAMAGE		N/A	N/A	N/A	N/A	N/A	
29 PALLETS	INTEGRITY, DAMAGE		N/A	N/A	N/A	N/A	N/A	
30 TREATMENT TANKS	PROPER OPERATION, LEAKS		N/A	N/A	N/A	N/A	N/A	
31 REFRIGERATOR	DAMAGED CONTAINERS		N/A	N/A	N/A	N/A	N/A	
32 SPILL CONTROL, FIRE AND EMERGENCY EQUIPMENT	PRESENT, AND IN GOOD WORKING ORDER							
33 INCINERATOR EMERGENCY WASTE FEED CUTOFF/ALARMS	PROPER OPERATING CONDITION		N/A	N/A	N/A	N/A	N/A	
34 INCINERATOR PUMPS VALVES, PIPES, MONITORING CONTROLS	LEAKS/SPILLS/TAMPERING OPERATING WITHIN SPECS.		N/A	N/A	N/A	N/A	N/A	
35 PRESSURE VESSELS (S-SITE)	DETERIORATION AND SAND CONDITION		N/A	N/A	N/A	N/A	N/A	
36 OIL BURN PANS (S-SITE)	DETERIORATION & LEAKS		N/A	N/A	N/A	N/A	N/A	
37 HE BURN PADS (S-SITE)	DETERIORATION VEGETATION, SAND COND., EROSION		N/A	N/A	N/A	N/A	N/A	
38 RADIOACTIVE EMISSIONS	ALPHA, BETA, GAMMA, TRITIUM							
39 DATE	DATE OF INSPECTION							
40 TIME	TIME OF INSPECTION							
41 INSPECTOR	INITIALS OF INSPECTOR							

PART II - For any AR (Action Required) in PART I above, describe below: action required, action taken, date of action. Attach additional sheets if necessary.

42 INSPECTOR 43 GROUP 44 DATE 45 TIME

DX DIVISION

STANDARD OPERATING PROCEDURE

FOR

PACKAGING AND TRANSPORTATION OF

HAZARDOUS MATERIALS

SOP-3

Prepared by: Stephen J DePaula
Stephen J. DePaula, DX-1
Date: 1-16-97

Approved by: ______
Kathy Smith, Group DX-1 ES&H Officer
Date: 1/16/97

Approved by: ______
ESH Deployed Team
Date: 3/21/97

Approved by: ______
B. Pruit Ginsberg, DX-1 Group Leader
Date: 3/20/97

Approved by: ______
DX-DO Operations Coordinator
Date: 3/21/97

CONTENTS

1.0 INTRODUCTION

The Dynamic Experimentation Division (DX) conducts operations and performs experiments requiring the use of various hazardous materials (HAZMAT) such as: Explosives, Gases, Flammable liquids and solids, Oxidizers, Poisons, Radioactive materials, Corrosives, and miscellaneous hazardous materials. Laboratory policy requires that all hazardous materials be packaged and shipped safely and in full compliance with all applicable regulations. This policy is intended to help ensure that personal, public and environmental exposures associated with the packaging and transportation of hazardous materials are minimized. Packaging and transportation of hazardous materials is regulated by the federal government and the DOE Explosives Safety Manual. This Standard Operating Procedure (SOP) describes methods to ensure DX Division personnel involved with all aspects of packaging and transportation of hazardous materials are in compliance with these regulations and policies.

2.0 PURPOSE

The purpose of this SOP is to describe the requirements and procedures to facilitate the safe handling and shipment of hazardous materials for movement within or outside of the Division.

3.0 SCOPE

This SOP is applicable to all DX-Division personnel involved the packaging and transportation of hazardous materials within the DX-Division Technical Areas (On-site), on public roads within Los Alamos County (Intra-Laboratory), and outside the Laboratory (Off-site).

4.0 DEFINITIONS

Authorized Personnel — A DX-Division employee who has demonstrated to his/her line manager the skills required to perform tasks associated with handling and transportation of hazardous materials. Individual is specifically authorized, in writing, by name, group, task and hazardous materials.

Hazardous Material (HAZMAT) — A material or substance that has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety and property when transported in commerce. The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials as defined in 49 CFR 171.8, materials listed in the Hazardous Materials Table 49 CFR 172.101 and

172.102, and materials that meet the defining criteria for hazard classes and divisions listed in 49 CFR 173.2.

HAZMAT Employee

A person employed by a HAZMAT employer who in the course of employment directly affects hazardous materials transportation safety. This term includes owner-operators of motor vehicles that transport hazardous materials in commerce. It also includes any individual who during the course of employment:

1. Loads, unloads or handles hazardous materials;
2. Tests, reconditions, repairs, modifies, marks or otherwise represents containers, drums, or packaging as being qualified for use in the transportation of hazardous materials;
3. Prepares hazardous materials for transportation;
4. Is responsible for safety of transporting hazardous materials; or
5. Operates a vehicle used to transport hazardous materials.

HAZMAT Employer

An employer who uses one or more of its employees in connection with the activities listed for a HAZMAT employee. The Los Alamos National Laboratory and its subcontractors are HAZMAT Employers.

Hazardous Materials Transfer Form (HMTF)

The Laboratory form that acts as a shipping manifest for non-radioactive hazardous materials shipped within the Laboratory. It contains such information as the names of the hazardous materials being transported, the quantities of HAZMAT being transported and an emergency response telephone number. (See attachments for an example of this form).

Intra-Laboratory

The movement of hazardous materials between Laboratory buildings, Technical Areas or across public roadways to which the public has uncontrolled access. Intra-Laboratory shipments must conform to DOT regulations.

Material Safety Data Sheet (MSDS)

The document that provides detailed technical information relating to a specific hazardous material. Required by OSHA to accompany hazardous materials in the workplace.

Off-Site	The movement of hazardous materials beyond the confines of the Laboratory to another site. The shipment must conform to DOT regulations.
On-Site	The transfer of hazardous materials between Laboratory buildings within controlled areas (not across roadways to which the public has access). The transfer must conform to the requirements of the LANL Packaging and Transportation Manual. On-Site is sometimes referred to as "behind the fence".
Originator (Customer)	The person or organization that owns the hazardous material and wishes to make an off-site, intra-laboratory or on-site shipment.
Packager	Performs the physical preparation of HAZMAT packaging, i.e. places material in packages, assembles internal packaging components, secures and fastens packaging, marks and labels the package.
Qualified Personnel	Personnel trained and certified to perform tasks associated with hazardous material packaging and transportation.
Radioactive Material Transfer Form (RMTF)	Same as HMTF. Specifically for Radioactive Materials.
Shipper	The person or organization shipping the hazardous material. Shipping includes classifying, preparing or signing shipping documents to ship or offer materials for shipment. LANL training requirements must be met before a person can be authorized as a qualified shipper at LANL.
UN Packaging	A packaging which conforms to the specifications in 49 CFR or the International Air Transport Association (IATA) Dangerous Goods Regulations. Sometimes referred to as UN Standard or Performance Oriented Packaging (POP).

5.0 RESPONSIBILITIES

5.1 DX-Division Line Management

- Ensures that the necessary policies, procedures, and resources are provided for Division personnel to perform the tasks required to safely package and transport hazardous materials.
- Provide a current listing of personnel within DX-Groups authorized to perform tasks associated with the handling and movement of hazardous materials within the Group.

5.2 DX-Division Packaging & Transportation Coordinator

- Identify, package, handle, mark, label and transport hazardous material and non-hazardous material for shipment on-site, intra-Laboratory and off-site.
- Prepare required shipping documentation for hazardous materials and non-hazardous materials. Documentation includes: HMTFs, RMTFs, Purchase Requests (PRs) Checklists and Shipping Manifests (SMs).
- Coordinate with Laboratory "Shippers of Record" for Division hazardous material shipments.
- Implement DOT, DOE, LANL, DX-Division, and DX-Group P&T policies and procedures.
- Develop and maintain the DX-Division P&T database for HAZMAT shipments.
- Earn and maintain certifications and qualifications as a LANL HAZMAT Shipper, Packager, Shipper by Air, RAM Shipper, Waste Shipper, and Explosives Shipper. Provide technical guidance for training requirements for DX-Division HAZMAT employees.
- Ensure that DX-Division P&T activities are in full compliance with all established directives.
- Mitigate improperly prepared HAZMAT shipments.
- Act as and coordinate oversight for all DX-Division internal and external P&T audits and assessments.
- Develop DX-Division P&T policies and procedures.
- Receive hazardous materials for the Division.

5.3 P&T Customer

- Submit DX-Division P&T Request for services in a timely manner to provide P&T Coordinators reasonable time to prepare shipment and meet Customer's required delivery date.
- Provide adequate information to enable P&T Coordinators to properly identify, package, mark, label and prepare required shipping papers to facilitate shipment. This includes an accurate, up-to-date MSDS for the material being shipped.
- Ensure that Consignee is authorized to receive HAZMAT.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Many of the chemicals used in homes on a daily basis are not regulated; however, once they are put to use in a "Laboratory Environment," they may be regulated and require that specific P&T procedures be followed for on-site, intra-laboratory and off-site shipment. If there is doubt whether a material is hazardous or not, contact the P&T Coordinators for a determination.

6.2 Currently, the Laboratory is permitted to move hazardous materials <u>On-Site</u>- within the confines of Laboratory recognized controlled access areas (behind the fence). These movements of HAZMAT are authorized by DOE because of controls demonstrated by the Laboratory. These controls, in the form of access control, employee training, and written safety procedures, allow for relief from DOT regulations and permit movement of hazardous materials as what normally would be a prohibited practice. DOE requires that On-Site movement of hazardous materials demonstrate the maximum control and safety of operation as practicable to accomplish the mission.

All <u>Intra-Laboratory and Off-Site</u> shipments of hazardous materials form DX Division shall be coordinated through the Division P&T Team.

6.3 DX-Division Line Management is required to identify and designate <u>authorized</u> personnel within specific groups who are permitted to handle and transport hazardous materials on-site. The DX-Division P&T Coordinators are the Laboratory <u>certified/qualified</u> shippers of HAZMAT for intra-Laboratory and off-site hazardous material shipments for the Division. DX-Division Waste Management Coordinators are the recognized shippers of waste for the Division.

6.4 A HAZMAT employee who performs any function regulated by hazardous material regulations may not perform that function unless he or she has received training as described in Subpart H of Part 172 of 49 CFR. Every HAZMAT employee must receive both initial and recurrent training that includes--

- General awareness/familiarization training
- Function-specific training
- Safety training
- Testing

In DX Division, personnel assigned to the P&T Team and the Waste Management Coordination Team are trained/certified HAZMAT Employees.

6.5 The P&T Customer is responsible for ensuring that materials being shipped are correctly identified as either hazardous or nonhazardous. Nonhazardous materials shall be screened to ensure they contain no explosive or radioactive contamination.

6.6 General Explosives Transportation Requirements (See attachment VII).

6.7 The P&T Customer is responsible for ensuring that persons or organizations intended to receive hazardous materials shipped from DX-Division are authorized and prepared to receive these shipments and that approved storage facilities exist for the materials shipped. For On-Site and Intra-Laboratory shipments this requirement is addressed in the LANL Administrative Manual, AR 6-6. Explosive shipments intended for non-DOE facilities shall be approved by the LANL Explosives Review Committee prior to shipment.

6.8 Off-Site shipments of hazardous materials are required to be processed through the Laboratory "Shipper of Record." Explosives, classed 1.1, 1.2 and 1.3, are transferred from DX-Division to ESA-WMA for Off-site shipment. Explosives, classed 1.4, may be transferred to ESA-WMA or BUS-4 for Off-Site shipment. Gases are transferred to the LANL Gas Plant for Off-site shipment. Wastes are transferred to CST for Off-site shipment. All other hazardous materials, to include Radioactive Materials, are transferred to BUS-4 for shipment Off-site.

7.0 PROCEDURAL STEPS

7.1 On-Site, Intra-Laboratory & Off-Site Shipments

7.1.1 On-Site

See **Attachment X** for On-Site P&T procedures.

On-Site shipments of hazardous materials are not regulated by DOT; however, Laboratory policy requires that site-specific activities be described and defensible with respect to the methodology and compliance process used to meet packaging and transportation safety requirements. Only authorized personnel may participate in packaging and shipping functions. These shipments may be of a routine nature, customary, usual, and/or repetitive to the organization. **Routine shipments** are normally conducted using approved packaging that meets the requirements of the DOE Explosives Safety Manual and DOT Regulations. **Nonroutine On-Site shipments** are emergency or one-time shipments of hazardous materials within controlled access areas for which there is no approved packaging. Line management shall decide that deviation from standard procedures is necessary to mission accomplishment and permit the deviation. Packages used in the transportation of nonroutine On-Site shipments of HAZMAT shall be adequate and provide the maximum safety possible. The package shall be designed to ensure that there will be no significant release of hazardous material into the environment. The containment measures shall take into account the likelihood and consequences of accidents, route and time of transit. An HMTF or RMTF shall be completed as appropriate and shall accompany the shipment. Emergency response information shall be entered on the transfer form with the person identified as the point of contact available/reachable during the time the shipment is in transit. The package shall be marked and labeled as appropriate to describe the hazards of the material being shipped. Vehicles used to transport hazardous materials shall be approved for such purposes, have the necessary installed safety and emergency equipment and shall be placarded when applicable (See Attachment VII). **Personnel performing On-Site hazardous material P&T functions shall be authorized to perform those tasks by their Group Management.** (See Attachment IX)

7.1.2 Intra-Laboratory

See **Attachment XI** for Intra-Laboratory P&T procedures.

Intra-Laboratory shipments of hazardous materials must comply with the requirements of DOE Orders, 49 CFR, other applicable regulations and Laboratory policies and procedures. Intra-Laboratory shipments of hazardous materials, in packaging that does not meet DOT requirements, become On-Site shipments and must be transferred over closed roads. Intra-Laboratory shipments of hazardous materials shall be made in authorized government vehicles operated by qualified Laboratory personnel. Training and safety requirements of 49 CFR and the Federal Motor Carrier Safety Regulations apply. An HMTF or RMTF, as appropriate, shall be completed and approved, to include emergency response information, for each Intra-Laboratory shipment and shall act as the Shipping Document. Procedural steps governing Off-site shipments shall be followed for Intra-Laboratory shipments of hazardous materials.

Only qualified HAZMAT personnel may perform Intra-Laboratory hazardous material P&T tasks.

7.1.3 Off-Site

See **Attachment XI** for Off-Site P&T procedures.

Off-site shipments of hazardous materials must be packaged, documented and transported by certified personnel in full compliance with applicable international, federal, state and Laboratory regulations. Off-site shipments of hazardous materials shall be processed through the appropriate Laboratory Shipper of Record. Before shipping hazardous materials off-site, the originator must include emergency response information in the shipping papers. The emergency response point of contact named on the shipping document must then be available to be contacted on a 24 hour basis while the shipment is in transit. The Laboratory Shipper of Record shall forward the emergency response information to the Laboratory emergency response organization before the shipment is released to the commercial carrier. A Shipping Manifest, HMTF or RMTF, as appropriate, shall be completed and approved and together with the MSDS, Emergency Response Guide Book extracts and any applicable exemptions, accompany the shipment to the Shipper of Record.

Only qualified HAZMAT personnel may perform Off-Site hazardous material P&T tasks.

7.2 Shipment Preparation

7.2.1 On-Site Shipments: (See Attachment X)

7.2.2 Intra-Laboratory Shipments: (See Attachment XI)

7.2.3 Off-Site Shipments: (See Attachment XI)

7.3 Quality Assurance

DX-Division P&T activities are conducted under the "umbrella" of the LANL Quality Assurance Plan for Hazardous Material Packaging and Transportation dated May 20. 1993.

7.4 Emergency Procedures

In case of a spill, the Division Waste Management Coordinator, the DX Division Facility Management Designee and the Building Contact shall be notified. If the spill occurs outdoors, the Team Leader with ownership for the area will be notified. If emergency help is needed, call 911. During all emergencies or incidents, Group Management shall be called as soon as possible.

Should an emergency situation arise while transporting explosives on-site, the driver is expected to use a two-way radio. Radios shall be available in HE transport vehicles to enable employees to call for assistance should an emergency or breakdown situation occur.

Instructions and guidelines to follow in the event of an emergency or breakdown with a vehicle carrying High Explosives

7.4.1 Accident / Fire

- Inspect the load for evidence of fire. If there is a fire but the explosive material is not presently or imminently involved, attempt to prevent the fire from spreading to the load. The fire may be fought using the vehicle's fire extinguisher. If explosive items are removed from the vehicle, ensure their security.

- If there is a fire that presently or imminently involves the load, evacuate all personnel to a minimum distance of 1250 feet from the vehicle. Block or divert traffic from the accident or fire. Notify and/or evacuate any potentially affected personnel.
- Unless the explosive cargo is imminently involved in the fire, the operator shall stay with the vehicle until proper disposition of the cargo is accomplished. Immediately notify the fire department of the accident / fire and provide information on the general type and a quantity of explosives involved. Notify the Group office.
- Because of the potential of toxic and radioactive fumes in the event of a fire, the transporter should move "upwind" if possible from the burning vehicle. The emergency radiation exposures and risk of injury to individuals involved in rescue and recovery shall be kept ALARA per 10 CFR 835.1302 and RPP 107-7 of the Radiation Protection Standards.

7.4.2 Mechanical Breakdown

- Remove the vehicle from the roadway as far as practical.
- Notify the appropriate authorities of the situation.
- Maintain visual contact with the vehicle
- If necessary, unload the vehicle to facilitate repair.

8.0 REQUIRED RECORDS - Not Applicable

9.0 REFERENCES

- Department of Transportation (DOT) Code of Federal Regulations (CFR) 49
- International Air Transport Association (IATA) Dangerous Goods Regulations
- Department of Energy (DOE) Orders 460.1/460.2, "Packaging and Transportation Safety"
- DOE Explosives Safety Manual
- Los Alamos National Laboratory (LANL) Environment, Safety and Health Manual
- LANL Packaging and Transportation Manual
- LANL BUS-4 Site Specific Work Procedures
- ESA-WMA Hazardous Materials (HAZMAT) Transportation Procedures

- DX-Division Operations Manual
- DX-Division Training and Qualification Manual
- 10 CFR 835 and RPP 107-7 (Radiation Protection Standards)

10.0 ATTACHMENTS

I. DX-Division P&T Request

II. LANL Hazardous Materials Transfer Form (HMTF), Form 1468 (2/95)

III. LANL Radioactive Materials Transfer Form (RMTF), Form 1586 (2/95)

IV. DX-Division HAZMAT Checklist for Off-Site / Intra-Laboratory Shipments

V. DX-Division Checklist for On-Site Explosives Shipments

VI. DX-Division Checklist for Off-Site / Intra-Laboratory Explosives Shipments

VII. General Explosives Transportation Requirements

VIII. DX-Division Personnel Authorized to Perform HAZMAT Functions

IX. Hazardous Materials Advisory Council Hazardous Materials Regulatory Reminder (HMAC HMRR) Checklist

X. DX Division On-Site P&T Procedures

XI. DX Division Intra-Laboratory and Off-Site P&T Procedures

XII. Record Of Annual Inspection

XIII. Driver's Vehicle Inspection Report

ATTACHMENT I

DX DIVISION P&T REQUEST

Send to P950 / Fax 667-6301
Stephen DePaula / Bill McGarity

FROM/ Z#	
DATE	
GROUP/PHONE/MS	
TA/BLDG./ROOM	

To Group or Organization	
Attn.: (name / Z#)	
PHONE/MS	
FAX(if Ram/Classified)	
TA/BLDG./ROOM/ Street Address if Off Site	

Item(s) to be Shipped

Quantity	Description	Line Value

Special Handling Requirements

____

____

check one:

Type of Material: ☐ Hazardous ☐ Non-Hazardous (inert)

MSDS Available: ☐ Yes ☐ No
(must accompany P&T Request if haz.)

Type of Shipment: ☐ On-sit ☐ Offsite Inta-Laboratory

Transportation Mode: ☐ FEDEX ☐ Air ☐ Lab Vehicle ☐ Surface

Classification: ☐ CRD ☐ SRD ☐ Unclassified

Check if shipping hazardous material:

☐ Oxidizer ☐ Explosives ☐ Flammable ☐ Corrosive ☐ Gases
☐ Poison ☐ Liquid ☐ Solid ☐ RAM ☐ Other

HAZARDOUS MATERIAL EMERGENCY RESPONSE CONTACTS

Name & Z#	Group	Office Telephone	After Hour Telephone
1)			
2)			

Cost Code/ Program Code/ Acct. Code:	
Requester/ Z#/Group #	
Required Delivery Date	
Explosive Review Committee Approval	

Written by S. J. DePaula, 11-2-96, revision

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ATTACHMENT H

HAZARDOUS MATERIALS TRANSFER
(Other Than Radioactive)

HM No.	SM No.	Date

GENERAL INSTRUCTIONS: This form is an official shipping document for transporting hazardous material within LANL boundaries. Type or print all entries. Material Safety Data Sheets (*MSDS*) and appropriate Emergency Response Guide information must be attached to this document. Distribution of completed forms is indicated below.

FROM						TO					
Name						Name					
Telephone	Group	TA	Building	Room		Telephone	Group	TA	Building	Room	

Item A	No. of Pkgs.	Proper Shipping Name	Hazard Class and Division	UN/NA Number	Packing Group	Net Qty. Wt./Vol.

Additional Description	Gross Weight	Required Labels	Required Placards

Packaging Used	Packaged By	Z Number	Date

Item B	No. of Pkgs.	Proper Shipping Name	Hazard Class and Division	UN/NA Number	Packing Group	Net Qty. Wt./Vol.

Additional Description	Gross Weight	Required Labels	Required Placards

Packaging Used	Packaged By	Z Number	Date

Item C	No. of Pkgs.	Proper Shipping Name	Hazard Class and Division	UN/NA Number	Packing Group	Net Qty. Wt./Vol.

Additional Description	Gross Weight	Required Labels	Required Placards

Packaging Used	Packaged By	Z Number	Date

Item A	Cost Code\Prog Code\Cost Acct\Wk Pkg	Item B	Cost Code\Prog Code\Cost Acct\Wk Pkg	Item C	Cost Code\Prog Code\Cost Acct\Wk Pkg
	Z Number		Z Number		Z Number

EMERGENCY RESPONSE TELEPHONE NUMBER: (505) 667-6211

EMERGENCY CONTACT TELEPHONE NUMBERS FOR INTRA-LABORATORY TRANSFERS

Name	Z Number	Group	Telephone Number	Emergency Response Guide Number(s)
				Item A ________ Item C ________
Name	Z Number	Group	Telephone Number	Item B ________

SHIPPER'S CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled/placarded, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper (*Signature*)	Z Number	Mail Stop	Date

ADDITIONAL TRANSPORTATION INFORMATION

Driver/Transporter	Z Number	Transport Vehicle License Tag Number	
Estimated Date and Time of Arrival	Material Received By	Z Number	Date/Time

Form 1468 (2/95)

LOS ALAMOS
NATIONAL LABORATORY

ATTACHMENT III

RADIOACTIVE MATERIALS TRANSFER

RM No.	SM No.	Cost Code\Prog Code\Cost Acct\Wk Pkg\Z Number	Date

GENERAL INSTRUCTIONS: This form is an official shipping document for transporting radioactive material within LANL boundaries. Type or print all entries. Emergency Response Guide Information must be attached to this document. Distribution of completed forms is indicated below.

FROM	Name				
	Telephone	Group	TA	Building	Room

TO	Name				
	Telephone	Group	TA	Building	Room

Item A

No. of Pkgs.	Proper Shipping Name	Hazard Class	UN/NA Number	Quantity (*Grams*)

Radionuclide (s)	Physical Form	Chemical Form	Activity	Label Category	Transport Index

Fissile Class	DOE or USNRC Identification Number	Additional Description (s)

Gross Weight	Rad. Level (*Surface*)	Required Placards	Packaging Used	Packaged By	Z Number	Date

Item B

No. of Pkgs.	Proper Shipping Name	Hazard Class	UN/NA Number	Quantity (*Grams*)

Radionuclide (s)	Physical Form	Chemical Form	Activity	Label Category	Transport Index

Fissile Class	DOE or USNRC Identification Number	Additional Description (s)

Gross Weight	Rad. Level (*Surface*)	Required Placards	Packaging Used	Packaged By	Z Number	Date

Radiation Control Technician (*Signature*)	Z Number	Date	
Pro-Force Representative (*Signature*)	Z Number	Date	Tamper ID

EMERGENCY RESPONSE TELEPHONE NUMBER: (505) 667-6211

EMERGENCY CONTACT TELEPHONE NUMBERS FOR ON-SITE TRANSFERS

Name	Z Number	Group	Telephone Number	Emergency Response Guide Number(s) Item A
Name	Z Number	Group	Telephone Number	Item B

SHIPPER'S CERTIFICATION

This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled/placarded, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper (*Signature*)	Z Number	Mail Stop	Date

ADDITIONAL TRANSPORTATION INFORMATION

Driver/Transporter	Z Number	Transport Vehicle License Tag Number		
Estimated Date and Time of Arrival		Material Received By	Z Number	Date

ATTACHMENT IV

DX DIVISION HAZARDOUS MATERIAL CHECKLIST FOR OFFSITE/INTRA-LABORATORY SHIPMENTS

PACKAGED BY and DATE	
DESTINATION OF SHIPMENT	
WORK ORDER. NUMBER	
ITEMS BEING SHIPPED	
REQUESTER	
CLASSIFICATION OF ITEMS	CRD UNCL

PACKAGING PROCEDURES

____ 1. Obtain a completed DX-DIVISION P&T REQUEST FORM

____ 2. Verify that shipping address is an approved one for CRD or UNCL

____ 3. Obtain MSDS

____ 4. Obtain items to be shipped

____ 5. If exemption is used

 ____ a) obtain and follow exemption

____ 6. Fill out a HMTF

 ____ a) If CRD make sure it is indicated and highlighted on HMTF

____ 7. Obtain appropriate shipping container in accordance with 49 CFR / exemption

____ 8. Obtain packing materials (foam, tape, trays, ect.)

____ 9. Package securely

____ 10. If CRD ensure CRD label is on outside of inner package only

____ 11. Place inner package inside outer package if CRD (per security requirements)

____ 12. Mark box in accordance with 49 CFR / exemption

____ 13. Place Hazard class & compatibility group labels on box in accordance with 49 CFR / exemption

____ 14. Movement of material by

 ____ a) ESA-WMA or BUS P&T

  ____ 1) Arrange for transfer

  ____ 2) Rough draft shipping manifest

  ____ 3) HMTF approval

  ____ 4) Offer placards (if needed)

 ____ b) DX-1 with exemption Only

  ____ 1) Type shipping manifest (if needed)

  ____ 2) HMTF approval

____ 15. Package with the following items must accompany the shipment

 ____ a) Emergency Response Guide
 (include: PSN, HC, UN, PG, Net. #)

 ____ b) Shipping Manifest (if required)

 ____ c) HMTF

 ____ d) MSDS

 ____ e) Exemption (if step #5 is used)

____ 16. Retain a copy of HMTF/ Shipping Manifest for DX-1 records

____ 17. Notify consignee of shipment

Checklist approved by: ______________________

Written by S. J. DePaula, 4-1-96, Revision

ATTACHMENT V

DX DIVISION CHECKLIST
FOR ONSITE EXPLOSIVE SHIPMENTS

PACKAGED BY and DATE	
DESTINATION OF SHIPMENT	
WORK ORDER. NUMBER	
ITEMS BEING SHIPPED	
REQUESTER	
CLASSIFICATION OF ITEMS	CRD UNCL

PACKAGING PROCEDURES

____ 1. Obtain a completed DX-DIVISION P&T REQUEST FORM

____ 2. Verify that shipping address is an approved one for CRD or UNCL

____ 3. Obtain MSDS

____ 4. Obtain items to be shipped

____ 5. Take to QC if required

____ 6. Record issues using HE accountability form and give cop; to HE Inventory Custodian (if not already done)

____ 7. If exemption is used

- ____ a) obtain exemption
- ____ b) obtain and proceed with exemption checklist

____ 8. Obtain appropriate shipping container

____ 9. Obtain packing materials (foam, tape, trays, ect.)

____ 10. Package securely

____ 11. Mark box in accordance with 49 CFR

____ 12. If CRD, place CRD label on outside of container

____ 13. Place Hazard class & compatibility group labels on box

____ 14. Fill out a HMTF

- ____ a) If CRD make sure it is indicated and highlighted on HMTF

____ 15. Movement of material by

- ____ a) ESA-WMA or BUS-4 P&T VAN
  - 1) Arrange for transfer
    - ____ a) ESA
    - ____ b) BUS-4
- ____ b) DX-1
  - 1) Get group office approval
  - 2) Must take radio
  - 3) HE vehicle must be used

____ 16. Package with the following items must accompany the shipment

- ____ a) Emergency Response Guide (include: PSN, HC, UN, PG, Net #)
- ____ b) HMTF
- ____ c) Exemption (if step #7 is used)
- ____ d) MSDS
- ____ e) QC (if required)

____ 17. Retain a copy of HMTF/ Shipping Manifest for DX-1 records

____ 18. Notify consignee of shipment

Written by S. J. DePaula 4-1-96. Revision

Checklist approved by:

ATTACHMENT VI

DX DIVISION CHECKLIST
FOR OFFSITE/INTRA-LABORATORY EXPLOSIVES SHIPMENT

PACKAGED BY and DATE	
DESTINATION OF SHIPMENT	
WORK ORDER. NUMBER	
ITEMS BEING SHIPPED	
REQUESTER	
CLASSIFICATION OF ITEMS	CRD UNCL

PACKAGING PROCEDURES

____ 1. Obtain a completed DX-DIVISION P&T REQUEST FORM

____ 2. Verify that shipping address is an approved one for CRD or UNCL

____ 3. Obtain MSDS

____ 4. Obtain items to be shipped

____ 5. Take to QC if required

____ 6. Record issues using HE accountability form and give copy to HE Inventory Custodian (if not already done)

____ 7. If exemption is used

____ a) obtain exemption

____ b) obtain and proceed with exemption checklist

____ 8. Obtain appropriate shipping container

____ 9. Obtain packing materials (foam, tape, trays, ect.)

____ 10. Package securely

____ 11. If CRD ensure CRD label is on outside of inner package only

____ 12. Place inner package inside outer package if CRD (per security requirements)

____ 13. Mark box in accordance with 49 CFR

____ 14. Place Hazard class & compatibility group labels on box

____ 15. Fill out a HMTF

____ a) If CRD make sure it is indicated and highlighted on HMTF

____ 16. Movement of material by

____ a) ESA-WMA

1) Arrange for transfer

2) Rough draft shipping manifest (offsite only)

3) HMTF approval (intra-lab only)

____ b) DX-1 with Exemption Only

1) Get group office approval / radio

2) Type shipping manifest (offsite only)

3) HMTF approval

____ 17. Package with the following items must accompany the shipment

____ a) Emergency Response Guide
(include: PSN, HC, UN, PG, Net #)

____ b) Shipping Manifest (if required)

____ c) HMTF

____ d) MSDS

____ e) QC (if step #5 was required)

____ f) Exemption (if step #7 is used)

____ 18. Retain a copy of HMTF/ Shipping Manifest for DX-1 records

____ 19. NOTIFY consignee of shipment

Checklist approved by:

Written by S. J. DePaula. 4-1-96. Revision

ATTACHMENT VII

GENERAL EXPLOSIVES TRANSPORTATION REQUIREMENTS

1. Vehicles used to transport HE shall have wheel chocks, tie down straps and tie down points/rings to secure the load.
2. When transporting HE, there shall be no loose items, such as handling gear, in the cargo compartment of the vehicle.
3. Rear view mirrors shall be installed/mounted on each side of an HE designated vehicle.
4. One fire extinguisher with a minimum rating of 2A:10BC shall be installed on all HE vehicles.
5. An annual inspection of all HE vehicles shall be accomplished during the annual review of this SOP (See Attachment XII). An operational safety inspection shall be conducted on each HE vehicle prior to daily operation (See Attachment XIII).
6. Safety related equipment checks and repairs shall be performed by maintenance personnel during regularly scheduled maintenance periods.
7. The speed limit for vehicles transporting HE within DX-Division Technical Areas (TAs) is 25 MPH. The speed limit for vehicles transporting HE on roads between TAs is 35 MPH unless a lower speed limit is posted.
8. Explosives shall not be left in vehicles overnight or in unattended vehicles (out of sight of operator).
9. When parking an HE vehicle equipped with a manual transmission, the ignition switch shall be turned off, the vehicle transmission placed in first gear and the emergency brake set. Vehicles equipped with automatic transmissions shall be placed in "park" and the emergency brake set when parked.
10. A rear wheel shall be secured front and rear with wheel chocks when an HE vehicles is parked on a significant grade.
11. Group management approvals shall be obtained prior to transporting explosives.
12. The driver shall, at all times, demonstrate professional actions, behavior, manners and attitude.
13. Fueling or maintenance of vehicles containing explosives is forbidden.
14. No smoking or spark/flame producing devices are allowed within 100 feet of vehicles containing explosives.
15. Explosive containers shall not be opened while inside a vehicle. An exception to this requirement is when explosives must be inspected in an emergency.
16. Government vehicles transporting HE shall not push or tow other vehicles.
17. Vehicle engines shall be off during loading and unloading of HE.

18. Vehicles shall not be operated closer than 25 feet of exposed explosives, magazines, or other HE buildings when the facility doors are open.

19. Low energy electro-explosive devices (EEDs) shall not be transported with other explosives.

20. Personnel are forbidden from riding in the cargo compartment of a vehicle transporting explosives.

21. Explosives shall not be transported during poor visibility, heavy snowfall, fog or during heavy rainfall.

22. Transportation of explosives during a lightning storm is forbidden.

23. When transporting explosives, the driver shall keep a two-way radio with him/her at all times.

24. A physical barrier shall be installed/in-place between the driver and the cargo compartment of vehicles transporting explosives.

Attachment VIII

DX PERSONNEL AUTHORIZED TO PERFORM HAZMAT FUNCTIONS ON-SITE

Name	Group	HAZMAT	Tasks/Authorizations

TTACHMENT IX

HAZARDOUS MATERIALS ADVISORY COUNCIL
1101 VERMONT AVENUE, NW
SUITE 301
WASHINGTON, DC 20005-3521

HM Regulations Reminder (HMRR) 49 CFR Non-Bulk By Highway

IDENTIFICATION

Proper Shipping Name (§172.101(c))[1] ______________________________

Technical Name(s) (§172.203(k))[15] ______________________________

Class /Division (§172.101(d))[2] __________ UN/NA# (§172.101(e))[2] ______________

Packing Group (§172.101(f))[3] ________

Other (§171.8) Hazardous Substance [17] ______ Materials Poisonous By Inhalation [27] ________

PACKAGING (Part 173)

A. Quantity PER Package [30] ______________

B. Packaging Authorizations (§172.101(i))[30] Column (8A) __________ Column (8B) __________

C. Special Provisions (§172.102(a))[31] ______________________

D. Packaging Selection(172.101(i))[31] Single _____ Combination _____ Outer Pkg. __________

E. General Packaging (172.101(i))[32] ______

MARKING

A. Proper Shipping Name (§172.301(a))[43]

B. Technical Name(s) (§172.301(b))[43]

C. UN/NA Number (§172.301(a))[43]

D. Name and Address (§172.301(d))[43]

E. Orientation Arrows (§172.312(a))[44]

F. Haz.Substance (§172.324)[45]

G. Packaging Spec. Marks (§178.503)[45]

H. Inhalation Hazard (§172.313(a)) [45]
H. 6.1 Plastic Packagings (§172.313(b))[45]

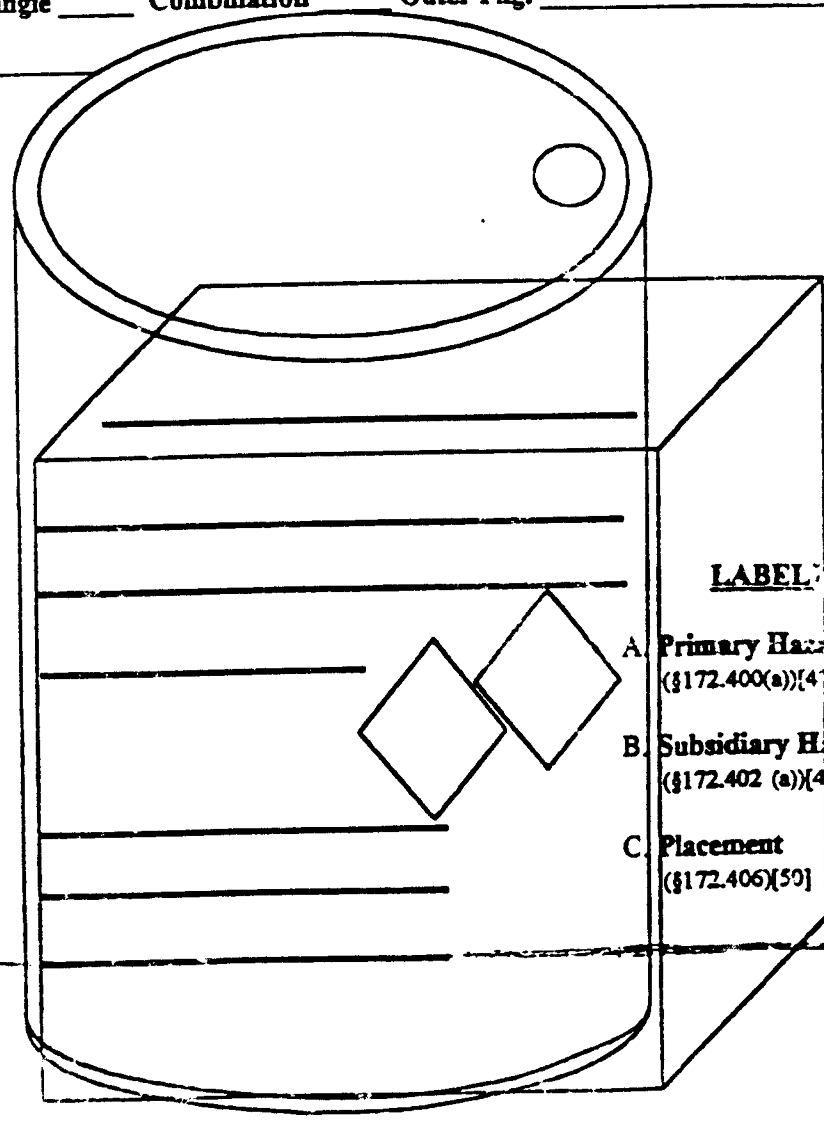
I. Exemption (DOT-E###)(§172.301(c))[46]

J. Radioactive Materials [46]

K. Overpack (§173.25(a))[46]

L. ORM Designation (§172.316(a))[46]

M. Class 1 EX Number (§172.320)[46]



LABELING

A. Primary Hazard (§172.400(a))[47]

B. Subsidiary Haza (§172.402 (a))[48]

C. Placement (§172.406)[50]

Appendix IV

SHIPPING PAPERS(Sub Part C)

BASIC DESCRIPTION (§172.202)

A. **Proper Shipping Name** (§172.202(a)(1))[53]

B. **Technical Name(s)** (§172.203(k))[53]

C. **Hazard ClassDivision** (§172.202(a)(2))[54]

D. **UN/NA Number** (§172.202(a)(3))[54]

E. **Packing Group** (§172.202(a)(4))[54]

F. **Sequence** (§172.202(b))[54]

G. **Total Qty.(Gross or Net)** (§172.202(a)(5))[54]

H. **Emer.Response Tele. No.**(§172.604(a))[55]

ADDITIONAL DESCRIPTION (§172.203)

A. **DOT-E Number** (§172.203(a))[55]

B. **Ltd Qty** (§172.203(b))[55]

C. **Hazardous Substance** (RQ/Name) (§172.203(c))[56]

D. **Dangerous When Wet** (§172.203(j))[56]

E. **Poison/Name**(§172.203(m)(1))[56]

E. **Inhalation Hazard/Zone** (§172.203(m)(3))[57]

F. Hazardous Wastes [57]

G. **RESIDUE: Last Contained** (§172.203(e)(3))[58]

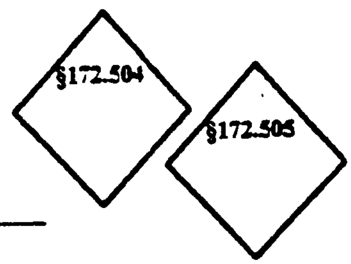
Straight Bill

Number & Type of Units	HM	(Proper Shipping Name, Hazard Class, UN/NA Number, Packing Group)	Net Quantity	Gross Weight

A. **Certification** (§172.204 (a))[61]

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

B. **Signature** (§172.204(d))[61] ______________________ (Signature)



PLACARDING (Sub Part F) Initial Emergency Response Information (Sub Part G)

A. **Placards Selected and Offered** (§172.504/505)[62] ______________________

B. **Placards Not Provided/Refused** [64]: Placarded __________ <454 kg Table II __________ Ltd Qty __________

C. **Properly Affixed/Displayed** (§172.504/516)[D. on 65] ______________________

D. **Emergency Response Information** (§172.602(a))[87] ____________

General Notes and Comments

____

____

____

____

ATTACHMENT X

DX DIVISION ON-SITE P&T PROCEDURES

N/A	YES	NO	TASK
			Authorized to perform P&T task.
			Authorized to handle this hazardous material.
			Recipient authorized to receive this hazardous material
			Vehicle inspected and equipped for transporting HAZMAT
			HAZMAT Identified
			Proper Shipping Name
			Technical Name (if required)
			Hazard Class and Division
			UN Number
			Other (Hazardous Substance, Materials Poison By Inhalation)
			Packaging
			Quantity per package
			Authorized packaging (Group Management approval required if packaging used is non-standard)
			General packaging requirements met
			Marking
			Proper Shipping Name
			Technical Name (s)
			UN Number
			To and From Address
			Orientation Arrows (if required)
			Hazardous Substance (if required)
			Inhalation Hazard (if required)
			Exemption # (if used)
			Radioactive Materials (if required)
			Class 1 EX Number (if required)
			Labeling
			Primary Hazard
			Subsidiary Hazard (if required)
			Placement
N/A	YES	NO	TASK
			HMTF or RMTF completed

			Hazardous Materials securely tied-down
			Vehicle Placarded (if required)
			Obtain Group Management (or designee) approval to transport
			Consignee available to receive hazardous material
			Consignee signs HMTF or RMTF as receipt
			HMTF or RMTF filed

ATTACHMENT X

DX DIVISION ON-SITE P&T PROCEDURES

N/A	YES	NO	TASK
			Authorized to perform P&T task.
			Authorized to handle this hazardous material.
			Recipient authorized to receive this hazardous material
			Vehicle inspected and equipped for transporting HAZMAT
			HAZMAT Identified
			Proper Shipping Name
			Technical Name (if required)
			Hazard Class and Division
			UN Number
			Other (Hazardous Substance, Materials Poison By Inhalation)
			Packaging
			Quantity per package
			Authorized packaging (Group Management approval required if packaging used is non-standard)
			General packaging requirements met
			Marking
			Proper Shipping Name
			Technical Name (s)
			UN Number
			To and From Address
			Orientation Arrows (if required)
			Hazardous Substance (if required)
			Inhalation Hazard (if required)
			Exemption # (if used)
			Radioactive Materials (if required)
			Class 1 EX Number (if required)
			Labeling
			Primary Hazard
			Subsidiary Hazard (if required)
			Placement
N/A	YES	NO	TASK
			HMTF or RMTF completed

			Hazardous Materials securely tied-down
			Vehicle Placarded (if required)
			Obtain Group Management (or designee) approval to transport
			Consignee available to receive hazardous material
			Consignee signs HMTF or RMTF as receipt
			HMTF or RMTF filed

ATTACHMENT XI

A. Identification

The first step in the procedure to be followed by all HAZMAT employees, who offer products for transportation, is to determine if the material that is being shipped is regulated as a hazardous material. If the material is regulated as a hazardous material, it must be shipped using the prescribed shipping name and description, packaging, labeling, marking, and must be handled as required by regulations.

You must also be aware of any exceptions which may be authorized within the regulations for specific quantities or hazard classes of materials. An exception means that, when authorized within the regulations, and when specific conditions are met, certain materials may not require full compliance with all of the regulations.

The key to proper identification of a hazardous material is information. Gather as much information as possible prior to beginning the shipping process. Sources of information include: MSDSs, asking specific questions about the material and past practices, if they were done correctly.

Determine if the material is regulated as hazardous material, in the intended mode of transportation, in the quantity being shipped. Using the Hazardous Materials Table (HMT) in 49 CFR 172.101 and the following checklist, determine the proper shipping name (PSN):

1. **Is the material listed by technical name in Column (2)?**

   Yes. It is a regulated hazardous material. Go to Item 2.
   No. It MAY be a regulated hazardous material. Go to Item 6.

2. **Is the material listed in Column (2) in Roman Type (not italics)?**

   Yes. It IS a proper shipping name. Go to Item 3.
   No. It MAY NOT be used as a proper shipping name.
   See the entry following the name in italics. Go to Item 3.

3. **Is the material listed in Column (2) technically pure?**

   Yes. It may be used as the proper shipping name, Go to Item 5.
   No. You may need to select an alternate proper shipping name. Go to Item 4.

4. **Is the material in a mixture or solution with other materials, either hazardous or non-hazardous?**

Yes. Select an alternate PSN using the information in Step #1, such as n.o.s., mixture or solution descriptions, etc. For materials which meet the definition of more than one hazard class, consult the Precedence of Hazard Table (49 CFR 173.2(b)). Go to Item 5.

No. Go to Item 5.

5. **After selecting the PSN for the material, check Column (1) of the HMT. Is there a symbol in Column (1), preceding the entry you have selected?**

Yes. Review 49 CFR 172.101(b) that describes the applicability of the symbol in Column (1) to determine if the material is regulated in the intended mode of transportation and if the PSN is authorized. Go to Item 6.

No. The material is regulated by all modes using the PSN you have selected, unless otherwise excepted. Go to Item 6.

6. **If the material identified by the PSN is listed in Appendix "A" of the HMT (49 CFR 172.101) and meets or exceeds the reportable quantity (RQ) listed, it is also an environmentally hazardous substance.**

- Is the material being shipped a hazardous substance?
- Is the material being shipped a marine pollutant?
- Is it both a hazardous substance and a marine pollutant?

Yes. Review Step #1 to select the PSN.

No. Continue - Go to Item 7.

7. **Do the PSN, Hazard Class/Division, UN Identification Number, Packing Group, Special Provisions, Packaging authorization, Quantity limitations, and physical characteristics meet the regulatory requirements and modal considerations for this shipment?**

Yes. Go to Item 8.

No. Review Step #1.

8. **Are the materials poisonous by inhalation?**

Yes. (Keep in mind for Marking - 7.2.3 Item 7, Labeling and Shipping Papers)

No. Checklist complete. Proceed to Package Selection.

B. Package Selection

Each hazard class presents its own unique characteristics which have been take into consideration for determining the safest and most efficient packaging to be use during transportation. As a result of historical experience and extensive testing, specific packaging has been selected for each material to be shipped. This selected packaging is referred to as "authorized" packaging. Only authorized packaging may be used to transport hazardous materials.

When specification packaging is required, hazardous materials shipments must only be offered for transportation when the applicable packaging has been used and the required performance testing has been conducted to qualify the packaging for use. The criteria for testing packages and packaging are found in 49 CFR 178.602-609.

When tests are conducted and packages or packaging are certified as meeting the UN Standard, the packaging manufacturer or other persons conducting the testing, must mark each container with the required specification marking which serves as the official certification. Records of the testing, names and locations where the testing was conducted and the results of those tests are retained for two years and are subject to DOT review at any time. The standards for packaging and the codes for each are found in 49 CFR 178.504 through 178.523. HM 181 and 49 CFR require that all packages and packaging meet or exceed UN Standards.

Using the Proper Shipping Name (PSN) selected, use the following checklist to determine the appropriate package/packaging for each hazardous material to be shipped.

1. **Does an entry appear in Column (8A)?**

   Yes. Go to Item 2.
   No. Go to Item 3.

2. **Read the section listed in Column (8A) and proceed to Section 173.-----. Does the material to be shipped qualify for an exception in the quantity and type of packaging selected?**

   Yes. Follow the packaging instructions for the "exceptions" as authorized. Go to Item 8.
   No. Go to Item 3.

3. **Will the material be shipped in a non-bulk packaging (49 CFR 171.8)?**

   Yes Read the section listed in Column (8B) and select authorized packaging. Go to Item 5.
   No. Go to Item 4.

4. **Will the material be shipped in Bulk packaging (49 CFR 171.8)?**

Yes. Read the section listed in Column (8C) and select authorized packaging. Go to Item 5.
No. Go to Item 6.

5. **Are special provisions listed in Column (7)?**

Yes. Read and follow the appropriate Special Provisions in 172.102 which correspond to the code in Column (7), in addition to the packaging authorization in Column (8). Go to Item 6.
No. Go to Item 6.

6. **Check Column (5) of the HMT. Check the performance level (X,Y,Z for Packing Group qualification) code within the UN package marking. If a Packing Group is listed in Column (5) does the packaging selected meet or exceed the performance level testing criteria and marking for that Packing Group?**

Yes. Go to Item 7.
No. Select an alternate packaging which meets the performance level for the Packing Group listed. Go to Item 7.

7. **Is the packaging marked with the proper code within the UN marking to qualify it for use with the material which will be put in the container?**

Yes. Go to Item 8.
No. Select an alternate packaging which qualifies for use with the intended contents. Go to Item 8.

8. **Does the completed package comply with the General Packaging Standards for all packages in 49 CFR 173?**

Yes. Go to Item 9.
No. Make necessary corrections. Go to Item 9.

9. **If specification packaging is required, has the package been tested and marked to show that it is qualified to be used in transportation, for the material contained within the package, by displaying the appropriate UN or DOT specification markings and packaging manufacturers symbol?**

Yes. Checklist completed.
No. Review Step #1. Select alternate packaging.

NOTE!!! DO NOT EXCEED THE QUANTITY PER PACKAGE.

C. Marking

Markings on packaging containing hazardous materials offered for transportation provide essential information for communicating the hazards which may be present in the package, and for verifying that the package is appropriate for the contents.

Using the PSN and the package selected, use the following checklist to determine the appropriate Marking for the shipment.

1. **The container is a non-bulk package.**

   Yes. Go to Item 2.
   No. It is a bulk package. Go to Item 9. (Item 9 deleted)

2. **The material has been re-named Consume Commodity and re-classified as ORM-D as permitted in Column (8A) of the HMT.**

   Yes. Mark the package with the PSN and the ORM-D marking. Go to Item 8.
   No. Go to Item 3.

3. **The material is being shipped under the Limited Quantity exception as permitted in Column (8A) of the HMT.**

   Yes. Mark the package with the PSN and the words "Limited Quantity." Go to Item 4
   No. Go to Item 4.

4. **Has the PSN, Technical Name, and any other required additional descriptions, and the identification number with the UN or NA prefix been legibly marked in English on the package?**

   Yes. Go to Item 5.
   No. Review the marking requirements in 49 CFR 172.300 and make corrections as appropriate. Go back to Item 1.

5. **Does the package contain inside containers with liquid contents?**

   Yes. Pack with closure upward and mark with orientation arrows to show "this end up". Go to Item 6.
   No. Go to Item 6.

6. **Does the package require marking with the name and address of the consignee or consignor?**

   Yes. Check for the required marking. Go to Item 7.
   No. Go to Item 7.

7. **Does the package contain Division 2.3 materials or 6.1 poisonous liquids which will be identified as "Poison--Inhalation Hazard" on the shipping paper? (reference 7.2.1, Item 8)**

   Yes. Check the package for the marking "Inhalation Hazard" in association with the required labels. Go to Item 8.
   No. Go to Item 8.

8. **Does the package contain material identified as a Hazardous Substance?**

   Yes. Check the package for the letters "RQ" in front of the PSN. Go to Item 9.
   No. Go to Item 9.

9. **Item 9 deals with Marine Pollutants. Disregard unless shipping by water. Go to Item 10.**

10. **Are all required markings visible on the package and unobstructed by labels or other markings that could make them ineffective?**

    Yes. Go to Item 11.
    No Review marking requirements in 49 CFR and make corrections. Go to Item 11.

11. **Have additional markings, when appropriate, been applied such as Warning for Class 6.1 (toxic) plastic containers, DOT-E ______, Radioactive Materials, Overpack, Class 1 EX Number?**

    Yes. Checklist completed.
    No. Review additional marking requirements in 49 CFR, make corrections. Checklist completed.

D. Labeling

Labels are a very important means of communicating the fact that hazardous materials are contained in a package offered for transportation, and also provide an easily recognized means of identifying the type of hazards involved. Labels communicate the hazards of the material contained within a package by means of their shape, color, and content. Each label required by DOT to be displayed on a package containing hazardous materials must be produced according to specifications in 49 CFR 172.407.

Using the PSN selected, determine the appropriate labeling to be applied to package of hazardous materials using the following checklist:

1. **Is the material identified as a regulated material in the HMT?**

Yes. Check Column (6) of the HMT, note all labels listed. Go to Item 2.
No. No labels required. Checklist completed.

2. **Is the material being shipped under an exception as "limited quantity", "small quantity", or other as listed in Column (8A) of the HMT?**

Yes. Check the requirements of the 49 CFR 173 Section found in Column (8A). Go to Item 3.
No. Go to Item 3.

3. **Has the material been classified as an ORM-D (Consumer Commodity) as authorized by Part 173?**

Yes. No labels required. Checklist completed.
No. Go to Item 4.

4. **Does the material meet the definition of any other hazard class, even though additional labels are not listed in Column (6)?**

Yes. Follow Subsidiary Hazard Labels Table in 49 CFR. Go to Item 5.
No. Go to Item 5.

5. **Does the package require labels representing the hazard class of the materials actually contained therein?**

Yes. Affix the required labels to the package. Go to Item 6.
No. No labels may be displayed on the package. Go to Item 6.

6. **Are labels affixed as indicated below?**

- Securely affixed to any surface other than the bottom
- On the SAME side as the PSN marking if the package is large enough
- On a background of contrasting color or have a contrasting border
- Visible and not obscured by markings or attachments
- Multiple labels, when required, displayed next to each other (subsidiary should be adjacent to the right and below primary)
- Primary hazard label with Class and/or Division number in lower quadrant
- Subsidiary hazard with NO Class or Division number displayed in lower quadrant.
- Multiple labels when required for larger packages
- Proper color, size, specification and orientation (diamond on point, writing horizontal, readable left to right)
- ALL labels visible when overpacked or placed inside an outer container OR additional labels on the outside container

- All modal label requirements checked and labels or stick-on type markings affixed if required (CARGO AIRCRAFT ONLY, MARINE POLLUTANTS, etc.)

  Yes. Labels comply. Checklist completed.
  No. Review 49 CFR 172.401-450, make corrections and complete checklist again

E. Prepare Shipping Papers

The Shipping Paper is a very important part of the communication process for identifying hazardous materials which are offered in transportation and, if properly prepared, provides vital information for emergency response personnel in the event of an accident.

DX-Division personnel do not prepare shipping papers since shipping papers are prepared by the Laboratory "Shipper of Record" for the hazardous material being shipped. However, the Shipper of Record will require specific information from DX-Division P&T personnel to facilitate the shipment. DX-Division P&T personnel shall provide shipping paper information in draft form to the Laboratory Shipper of Record.

The following information is required as appropriate:

- Proper Shipping Name
- Technical Name
- Hazard Class/Division
- UN/NA Number
- Packing Group
- Total Quantity (Gross or Net)
- 24 Hour Emergency Response Names (2)
  - Work Telephone Number
  - Home Telephone Number
- DOT- E Number
- Limited Quantity
- Hazardous Substance (RQ / Name)
- Dangerous When Wet
- Poison / Name
- Inhalation Hazard / Zone
- Hazardous Wastes
- RESIDUE: Last Contained

F. Placarding

Placards are used to communicate the hazards within a cargo transport vehicle which contains certain packages of hazardous materials when offered for transportation. Placards are required to be constructed of durable material with minimum dimensions specified in 49 CFR 172.519. When properly displayed in transportation, placards provide emergency responders with a warning sign identifying hazardous materials which may pose health or safety problems in an accident.

DX-Division personnel are not normally required to transport hazardous materials in commerce. Placarding of vehicles transporting hazardous materials Off-site and Intra-Laboratory is the responsibility of the Laboratory Shipper of Record and the Carrier. However, DX-Division HAZMAT personnel may be required to transport HAZMAT On-Site, thus requiring placards.

DX-Division HAZMAT personnel transporting hazardous materials ON-Site shall placard the transport vehicle as required by 49 CFR 172.504, Table 1 or 2. If Placards are required, they shall comply with display requirements outlined in 49 CFR 172.504-519.

G. Exceptions

1. General Procedures

Elements of DX-Division as well as other organizations in the DOE Complex create new explosives to be used and tested for future projects. A new explosive is (1) an explosive produced by a person who has not previously produced that explosive or (2) an explosive previously produced by a person who has made a change in the formulation, design or process so as to alter any of the properties of the explosive.

Transportation regulations require new explosives be approved by a competent authority. The authority in the United States is the Associate Administrator for Hazardous Material Safety.

New explosives made by or under the supervision of the DOD or the DOE may be approved in the same manner as commercial explosives producers through Bureau of Explosives or the Bureau of Mines; or through examination, testing and approval by either the designated Army, Navy, or Air Force component of DOD, or by the Department of Energy. The classifying entity sponsoring development of an explosive item or assembly is responsible for developing necessary data. This data is used to assign an appropriate hazard class/division, compatibility group, DOT shipping description, DOT label and UN number. A report of each approval granted by DOD or DOE(with supporting laboratory data) must be filed with the DOT Associate Administrator and an acknowledgment must be received prior to offering the new explosive for transportation.

2. Interim Hazard Classifications

An Interim Hazard Classification (IHC) exemption temporarily authorizes transportation of new explosives when offered by DOE contractors under commercial bills of lading. The IHC is not applicable for shipment of explosives by private contractors for non-DOE contracts. The organization sponsoring development of an explosive substance or assembly is responsible for requesting the IHC and for providing supporting data to the responsible DOE IHC authority. Any change in packaging or explosive components in an item requires reexamination of the item by the responsible IHC authority to ascertain the need for revision of the IHC. An IHC exemption may be issued for a period up to one year. Extension beyond one year requires a request from the originator, with justification, for renewal by the issuing organization.

3. Explosive Numbers (EX Numbers)

EX Numbers are assigned to new explosives after considerable testing and analysis. A written request for a permanent classification action is prepared stating the proposed classification, method of packaging, marking, labeling, and mode of transportation. Applicable supporting data is submitted along with the request to the responsible DOE Operations Office. Upon review and determination that the request is proper and the data supports the hazard classification assignment, the operations office will approve the request, assign permanent classification, and issue a classification approval document. Copies of the classification approval document and supporting data are submitted to DOE Headquarters for a submittal review and filing with DOT. The official submittal by HQ/DOE to DOT formally requests the DOT registration of the material being classified. Under DOT's new explosives classification program DOT Competent Authority Approval is provided along with the registration (EX-Number).

4. DOT Exemptions

The use of DOT Exemptions for the packaging and transportation of hazardous materials is authorized in accordance DOT regulations specified in 49 CFR 171-180. The DOT exemption procedures for DOE contractors are detailed in DOE Order 1540.2, "Hazardous Material Packaging for Transport - Administrative Procedures."

ATTACHMENT XII

DX ANNUAL VEHICLE CHECKLIST

DATE:
TAG NUMBER:
INSPECTOR:

SECTION TO CHECK	OK	NOT OK	NA	COMMENTS
TIRES				
BODY				
DOORS & LOCKS				
TAILGATE				
WINDSHIELD				
WINDOWS				
MIRRORS				
HEADLIGHTS				
Brights				
Dims				
TURN SIGNALS				
BRAKE LIGHTS				
BACK-UP LIGHTS				
PARKING LIGHTS				
HORN				
WIPERS				
WINDSHIELD WASHER				
RADIO				
HEATER				
DEFROSTER				
AIR CONDITIONER				
UPHOLSTERY				
GENERAL INTERIOR				
SPARE TIRE				
BRAKES				
EMERGENCY BRAKE				
NOISES				
LEAKS (Gas, Oil, Ect.)				
EMERGENCY FLASHERS				
FIRE EXTINGUISHERS				
TIE DOWNS				
WHEEL CHOCKS				
OTHER				

ATTACHMENT XIII

DX VEHICLE CHECKLIST

DATE:
TAG NUMBER:
COORDINATOR:

SECTION	OK	NOT OK	NA	COMMENTS / SIGNATURE
Radiological Check				
Tires				
Wheel wells				
Under frame				
Engine air filter				
Trunk				
Bed				
Floorboard				
Under seats				
Glove box				
Passenger area				
Driver area				
Other				
Explosive Check *Visual*				
Explosive Check *Smear*				
Hazardous Material Check				
Glove box				
Behind seats				
Floor				
Trunk				
Bed				
Tool box				
Other				

DX-2

STANDARD OPERATING PROCEDURE

FOR

DESTRUCTION OF
HE-CONTAMINATED WASTE AND HE WASTE

6.1.5

Prepared by: Gordon Jio Date: 1/29/96
G. Jio, DX-2

Prepared by: James R. Stine Date: 1/30/96
J. R. Stine, DX-2

Approved by: Date: 2/8/96
J. B. Snow, DX-2 Group Leader

Approved by: ____________ Date: ______
DX-DO

Approved by: ____________ Date: ______
ESH-5

Final Approval: ____________ Date: ______
Margaret K. Orbesen, Group DX-2 ES&H Officer

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Contents

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1.0 INTRODUCTION

Group DX-2 performs tests and operations on new high-explosives that have unknown properties and characteristics. These operations generate waste that cannot be sent to Group ESA-WMA for disposal because of its uncharacterized nature or experimental history. These wastes are destroyed at Technical Area (TA) 14 (Q-site East), by either burning or detonation. This SOP is a a prerequisite to DX-2:SOP 6.1, 'Q-Site East (TA-14) Firing Operations'.

2.0 PURPOSE

The purpose of this operation is to safely destroy HE waste and HE-contaminated waste originating in Group DX-2.

3.0 SCOPE

This SOP applies to all DX-2 personnel who perform the burning and detonation operations. These operations shall only be performed by Group DX-2 personnel at TA-14 Q-Site East, Building 23 and the adjacent firing area.

4.0 DEFINITIONS

HE-Contaminated Waste: Materials such as rags; paper; sample containers; Kimwipes; toothpicks; other process and clean-up waste with contaminated residual amounts of energetic material.

HE Waste: Damaged or suspect devices, consolidated or powder explosives that have undergone severe damage during testing, experimental explosives, explosives of temporary interest, newly synthesized compounds, new mixtures, and uncharacterized explosives.

5.0 RESPONSIBILITIES

5.1 Group Leader

- Ensures that the necessary policies, procedures, equipment, training, and manpower are available for this operation and delegates the responsibility for implementation of details to a designated Staff Member.

5.2 Designated Staff Member

- Implements the details for safely performing these operations.
- Chooses, along with the Group Leader, the Firing Site Leader.

5.3 Firing Site Leader

- Has primary responsibility for safe operations.
- Supervises routine burning and detonation operations.
- Trains operators.

5.4 Operator

- Is responsible for safe operations.
- Assists Firing Site Leader in the burning and detonation operations.

5.5 DX-DO Training Generalist

- Provides information on training for this operation. Training is in accordance with the Laboratory's Administrative Requirements (ARs) in the *Environment, Safety, and Health* Manual and the *DOE Explosives Safety Manual,* Chapter V.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Location, Composition, and Weight Limitations

Location, composition, and weight limitations depend on whether the waste will be destroyed by burning or by detonation. HE-contaminated waste will be burned, and HE waste will be detonated.

6.1.1 Burning Operation

HE-contaminated waste shall be burned in the burn cage (Fig. 1) located near Mound 3. The cage shall be positioned so that it is in full view from the observation ports in Room 101 of Building 23.

Only small samples of HE waste that would pose no hazard to the burn cage or the area, if they should burn rapidly, shall be burned in any one waste-disposal operation.

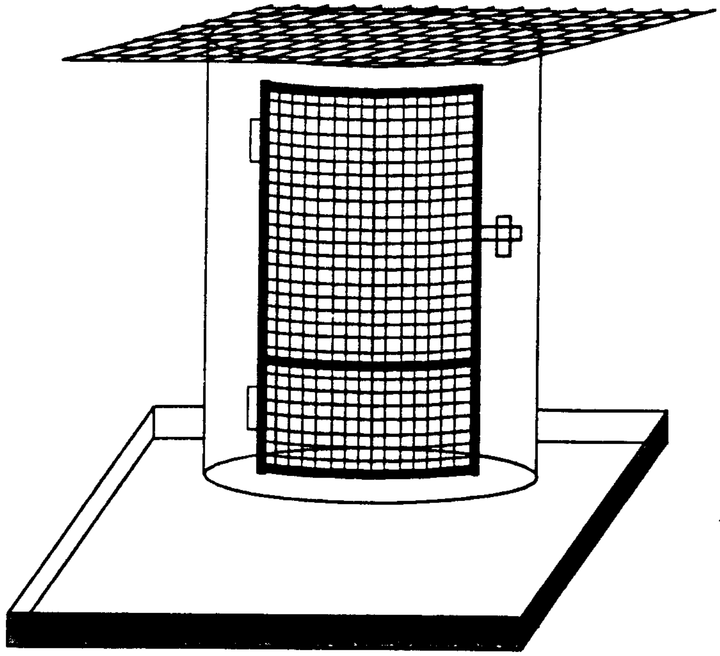

Fig. 1. Burn cage.

6.1.2 Detonation Operation

HE waste shall be destroyed by detonation on Mound 3.

6.1.3 Weight Limitations

Weight limitations are as follows.

Operation	Weight Limitation
Burning	50 lb of combustibles in each burn
Detonation	20-total lb per test

6.2 Personnel Limits

The personnel limits in DX-2:SOP 6.1, 'Q-Site East (TA-14) Firing Operations' shall be followed for this operation.

6.3 Transportation

The requirements for transporting HE-contaminated waste and small samples of HE waste for burning and detonation are listed below.

- Waste shall be transported directly to to the firing mound at TA-14 Q-Site East in accordance with DX-2:SOP 1.9, 'Packaging and On-Site Transportation of Explosives,' for on-site transportation.

- No quantity greater than that which can be disposed of in a single day shall be transported to TA-14 Q-Site East.

7.0 PROCEDURAL STEPS

7.1 Preparations Before Burning

Follow the procedures below when preparing to burn HE-contaminated waste.

Step	Action
1	• Notify appropriate ES&H contact (See Attachment) no less than 48 hours prior to the scheduled burn.
2	• Clear the area by driving to Q-Site West (TA-14-34) and Mound 5 at Q-Site East to make sure that no unauthorized personnel are within the site. • Alert any personnel at Q-Site West that a burn operation is to occur and inform them of the type of material involved.
3	Make sure that plenty of fuel is available to completely destroy the waste and the containers.
4	• Uncover the burn cage, • Check the burn cage to see that no metal or foreign objects are in the middle section where the waste will be placed, and • Remove any that are found.
5	• Check the bottom, or fuel space, for undestroyed material and • Wrap any that is found in paper and place it on the grate.

fuel
?

Step	Action
6	Open all containers, such as glass or plastic, where a pressure buildup could occur. **Note:** If waste containers are wet, return them to the originator for proper drying. **CAUTION** DO NOT combine materials. Keep all HEs in their separate containers.
7	Place the waste container on the grate, spaced so a good draft will result during burning.

7.2 Burning Operation

Follow the steps below for destroying HE-contaminated waste.

Step	Action
1	Short the end of the composition discharge unit (CDU) detonator cable.
2	Attach two igniters in parallel to the detonator cable and place them in the fuel space.
3	Sprinkle fuel on the HE-contaminated waste to enhance destruction of the waste and aid in ignition. **Note:** Use only volatile hydrocarbons, such as acetone, fuel oil, hexane, as a fuel. **CAU** fuel ? DO NOT use any material that c ; in its molecular composition. If in dou ted Staff Member in charge of Q-Site Eas
4	Cover the top of the burn cage wit.. ... wire mesh provided to minimize the escape of burning particles.

Step	Action
5	Fire the ignitors using the firing control unit in Room 101 of Building Q-23 (see DX-2:SOP 6.1, 'Q-Site East (TA-14) Firing Operations.). Note: The siren will go through its normal sequence, but the Firing Supervisor may turn the siren off after determining that the burn is progressing satisfactorily.
6	• Wait for at least 10 minutes after visible flaming has stopped and • Then sound the "all-clear" signal. Note: If there is still a considerable amount of smoke, the Firing Site Leader must use his judgment about delaying the all-clear signal.
7	In the event of a misfire, do not approach the area until at least 10 minutes have elapsed without any evidence of flames or smoke in the burn cage (See Attachment II).
8	DO NOT use the burn cage for another burn operation for 24 hours.
9	After 24 hours or more, remove the ashes and place in the satellite storage outside Building 23.
10	Cover the burn cage with a tarp.

7.3 Detonation Operation

HE waste that cannot be disposed of by ESA-WMA because of its nature or experimental history shall be destroyed by detonation at TA-14 Q-Site East. The steps below shall be followed for detonating HE waste.

Step	Action
1	Be sure you have a completed test sheet according to see DX-2:SOP 6.1, 'Q-Site East (TA-14) Firing Operations, signed by the designated Staff Member or alternate in charge of firing operations.
2	• Clear the area by driving to Q-Site West (TA-14-34) and Mound 5 at Q-Site East to make sure that no unauthorized personnel are within the site. • Alert any personnel at Q-Site West that a detonation operation is to occur and inform them of the type of material involved.

Step	Action
3	• Inspect Mound 3 and • Rake to remove any foreign materials such as metal fragments or rocks if necessary.
4	Place the HE to be disposed into a cardboard container.
5	Fill the container with less than or equal to 20 lbs total HE weight of bulk explosive, such as nitroguanidine (NQ).
6	Place a booster into the bulk explosive so that it makes good contact. **Notes:** • Consolidated explosives known to be less sensitive to impact than 10 cm on Type 12 tools, 15 cm on Type 12B tools, or resistant to more than 0.05 joules in the 3-mil lead-foil spark test may be removed from their containers, placed gently on clean sand, and fired with a booster taped to the charge or placed in contact with the charge. • More sensitive explosives or experimental HE without impact data will require a safety work permit (SWP).
7	Follow the instructions in DX-2:SOP 6.1, 'Q-Site East (TA-14) Firing Operations' to perform the test.
8	If a misfire occurs, follow procedure outlined in in DX-2:SOP 6.1, 'Q-Site East (TA-14) Firing Operations.'

7.4 Disposing of Waste

Waste generated from these operations shall be packaged and disposed of according to DX-2:SOP 1.5 'Disposal of Hazardous Materials and Contaminated Equipment.' Waste minimization will be handled according to the DX-Division Operations Manual, and AR-10-3.

7.5 Emergency Procedures

In the event of an emergency situation, the Building Emergency Plan (BEP)/ Site Emergency Plan (SEP) shall be followed. The BEP/SEP shall be available in Building Q-23 and the operators shall be familiar with its contents.

8.0 REQUIRED RECORDS

- DX-2:SOP 6.1 , 'Q-Site East (TA-14) Firing Operations'
- Completed and signed Test Sheet (for detonation or burning)
- DX-2 Q-Site East Check List, Burning of HE-Contaminated Waste

9.0 REFERENCES

- DOE Explosives fety Manual
- Los Alamos Environment, Safety, and Health Manual
- DX-Division Operation Manual
- DX-2:SOP 1.5, Disposal of Hazardous Materials
- DX-2:SOP 1.9, Packaging and On-Site Transportation of Explosives
- DX-2:SOP 6.1, Q-Site East (TA-14) Firing Operations
- Building Emergency Plan/Site Emergency Plan (BEP/SEP)
- AR-10-3

10.0 ATTACHMENTS

I. ES&H Contact List

II. DX-2 Q-Site Check List, Burning of HE Contaminated Waste

Attachment I

ES&H Contact List

The ESH-17 contacts are:

David Jardine	667-3615
Leland Maez	665-1240
Jean Dewart	665-0239

One of these people need to be contacted one to two days prior to each burn at Q-Site.

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Attachment II

DX-2 Q-Site Check List
Burning of HE-Contaminated Waste

Requester ______________________ Date Burned ______________

Charge Code ______________________

This checklist is intended for use as a safety supplement to DX-2:SOP 6.1.5 "Destruction of HE-Contaminated Waste and Waste HE." All Q-Site users must be familiar with the Group DX-2 SOPs 6.1 and 6.1.5. This checklist should be referred to by the Firing Supervisor subsequent to burning in the burn cage and prior to final arming. In the event of a misfire, follow the checklist on the other side of this page.

OK	N/A	
☐	☐	1) Secure and clear area.
☐	☐	2) Ensure burn cage is clean.
☐	☐	3) Open all glass and plastic containers.
☐	☐	4) Place waste material to be burned on grate.
☐	☐	5) Short end of detonator cable.
☐	☐	6) Attach ignitors to detonator cable and place ingitors near waste material.
☐	☐	7) Sprinkle fuel on waste material.
☐	☐	8) Cover top of burn cage with wire mesh.
☐	☐	9) Connect detonator cable to the Capacitor Discharge Unit (CDU).
☐	☐	10) Start firing sequence..
☐	☐	11) Fire ignitors.
☐	☐	12) Observe burning.
☐	☐	13) Turn off siren; (do NOT sound "all-clear.")
☐	☐	14) Wait 10 min. after flame has stopped and sound "all-clear."
☐	☐	15) Another batch cannot be burned until 24 hours has elapsed.
☐	☐	16) Clean up ashes (after 24 hours) and place in satellite storage outside TA-23.
☐	☐	17) Cover burn cage with tarp.

Signature ______________________ Date ______________

Firing Supervisor

FORM DATE 1/19/96 Approved by: ______________________ Date ______________

In the event of a misfire, the following procedure will be followed:

OK	N/A	
☐	☐	1) Do not sound the "all clear" and DO NOT LEAVE CONTROL ROOM.
☐	☐	2) Check all electrical connections and firing voltage in the control room.
☐	☐	3) Attempt to fire the shot again.
☐	☐	4) If the shot still does not fire, turn off all power to firing system.
☐	☐	5) Notify any any personnel who are at Q-Site of the misfire.
☐	☐	6) Wait a time considered appropriate by firing site supervisor (nominally 10 minutes) while observing the shot for any signs of smoke or activity.
☐	☐	7) If during the waiting period no activity is observed, <u>one</u> person shall approach the burn cage and disconnect the detonator cable from the CDU.
☐	☐	8) Disconnect the ignitor from the detonator cable.
☐	☐	9) Check detonator leads and cable for continuity with an approved meter ohm.
☐	☐	10) If the problem has been identified and corrected, firing operations may be checked by firing one or more ingitors.
☐	☐	11) If the problem cannot be identified, notify the DX-2 group office, secure the area, and await further instructions.

DX-4

STANDARD OPERATING PROCEDURE

FOR

GENERAL ACCESS CONTROL

SOP 1.0

Prepared by: Roger K London
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Date: 6-13-96

Approved by: John McCofer
DX-4 Group Leader
Date: 6/13/96

Approved by: C. M. Wood
DX-DO
Date: 6/21/96

Approved by: R. H. Gulde
Ew 6/25/96 ESH-5
Date: 6 Sep 96

ESH-5 SOP review process completed 9/4/96 PLM

Final Approval: G. G. Vasilik
G. Vasilik, DX-4 ES&H Officer
Date: 9/12/96

Controlled Document Number:

Table of Contents

1.0 INTRODUCTION

Access Control prevents people from accidentally being in the vicinity of an explosives test or other hazardous operation such as radiography, by imposing physical barriers and also administrative restrictions. DX Division personnel conduct test-firing operations involving explosives at DX Division firing sites at TA-15, TA-36, TA-39, and TA-40, and the TA-14 outdoor chemical laboratory. DX Division personnel and visitors must be assured of a safe working environment while they are in the DX Division firing areas.

2.0 PURPOSE

This Standard Operating Procedure (SOP) describes the general precautions and procedures for administering access to the DX Division firing areas.

3.0 SCOPE

This SOP applies to all individuals who require access to firing areas of TA-15, TA-36, TA-39, TA-40 and the test area at TA-14. Maps and site descriptions are given as Attachment 1.

This SOP does not describe detailed area Clearance Procedures conducted at each Firing Site. Clearance Procedures are described in DX-4 General Firing Operations and Site-specific SOPs.

"Firing area" refers to a large geographical area containing several firing sites, for example TA-40. "Firing site" refers to an individual Firing Point or Chamber, for example Eenie Site.

4.0 DEFINITIONS

Access Control: Access Control is governed by three Access Control Offices. The Access Control Office in TA-15-183 administers access into firing areas at TA-15, TA-36, and TA-39, and oversees the exchange badge process and controls visitor access into these firing areas. Access to TA-40 is administered by the DX-1 Group Office at TA-22-90. Access to TA-14 is via the DX-2 Group Office at TA-9-21.

Access to TA-39 is also handled through the Administrative Office at TA-39-2.

Access Gates: Gates or chains that can be locked. The keys are administratively controlled by the Access Control Office and Local Access Offices.

Perimeter Gate: A gate at the boundary of explosives buffer area. Keys are kept in the Access Control Office at R-183.

Safety Gate: A gate that marks the entrance to a Firing Point. The last gate before hazard is encountered, the safety gate may be interlocked.

Area K-I: Encompasses Kappa Site (TA-36), and the northern part of R-Site (TA-15) mesa east of the safety fence.

Area III: Encompasses the south leg of R-Site mesa where the PHERMEX firing site is located. It includes all of the mesa leg east of the North-South-running safety fence with the north, east, and south bounded by canyon rims.

Barricade: A portable device, such as a sawhorse, with an appropriate sign, used to halt traffic into an area that is hazardous or is about to become hazardous.

Clearance Plans: Procedures that protect personnel within the firing areas by controlling access during explosive experiments, radiographic operations, or other potentially hazardous operations. The level of the clearance plan determines the control procedures to be followed, an the extent of the cleared area.

Cleared Area: An area that has been physically patrolled by a person performing assigned duties, or an area in which all personnel have been accounted for. A Cleared Area has been declared safe for firing operations to proceed.

Escort: *During hazardous operations*, an escort is defined as a Knowledgeable Person, who is familiar with procedures and operations in the firing areas and who assumes responsibility for the safety of assigned visitors at the firing site.

During non-firing operations, escort refers to a Q-cleared person accompanying a non-Q-cleared person in secure areas.

Firing Area: The areas where firing operations are conducted. Access to these areas is controlled, and is through an Access Gate. These areas are Area K-I, Area III, TA-40 Firing Area, TA-39 Firing Area, and TA-14.

Firing Point or Site: The actual location of an explosive test and its exclusion area behind the appropriate safety gate.

Firing Leader: A full-time DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This person's accumulated knowledge and experience are crucial to all explosives firing operations.

Knowledgeable Person: A person, designated by the Group Leader or the Deputy Group Leader, deemed eligible for a pictured exchange badge because of specified training and experience. All other personnel are visitors.

Local Access Office: Access to TA-14, TA-39, and TA-40 is governed by Local Access Offices at TA-9, TA-39, and TA-22, respectively. These offices supplement the Access Control Office, and handle some visitor access. (See Access Control.)

Radiological Control Technician (RCT): An ESH-1 Employee who is DOE certified to perform and document radiological surveys according to specified Laboratory and DOE procedures. A specialist who monitors personnel, equipment, or firing sites for radioactivity, and documents the results.

Roadblock: A roadblock is established by having a DX Division employee or trained Knowledgeable Person (Clearance Patrolman) in the road to stop traffic. The roadblock may be an employee with a radio, or an employee with a radio and a vehicle. This person maintains contact with the Firing Leader and the Access Control Office as necessary. The roadblock may be a barricade in the center of the road with a sign stating that hazardous operations are in progress.

Safety Fence: A fence placed to indicate a separation of areas, usually a supplement to, and continuation of, a safety gate or an access gate.

TLD Badges: Thermoluminescent Dosimeter - A dosimeter which is in the form of a badge, intended to record the radiation dose received by the whole body of the wearer.

Visitor: A person in a firing area who has not met the requirements for a "Knowledgeable Person."

Escorted - Visitors who have not received site-specific training or are unfamiliar with operations, or who lack a Q clearance, and are escorted into firing areas.

Unescorted - A visitor who has received site-specific access orientation, and a Visitor's Badge, and may be in a firing area unescorted when no firing operations are in progress.

Visitor's Badge (V Badge) : A badge bearing a "V" instead of a picture, to be given to visitors who are not knowledgeable in local operations and procedures, but have received site-specific training.

5.0 RESPONSIBILITIES

5.1 Knowledgeable Person

- Responsible for safety and security of firing operations.
- Responsible for ensuring that access control and clearance procedures are properly conducted.
- Accepts personal ownership of working areas.
- In case of ES&H concerns, takes personal responsibility to see that proper actions are requested and implemented.
- May escort visitors.

5.2 Firing Leader

- Determines who is allowed access during firing or other hazardous operations.
- Oversees the safety of personnel, equipment, and facilities at the firing site.

5.3 Access Control Officer

- Administers personnel access into firing areas, and manages exchange badges where they are used.
- Verifies that requirements for visitor access are met. Maintains visitor access documents and records.

- Participates in clearance procedures as appropriate. Interacts with Firing Leader for firing operations.
- Enforces prohibition on matches and lighters.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Clearance Plans

Clearance Plans have been developed to protect personnel within the firing areas. Clearance Plans are specified for explosives firing operations, for radiographic operations or pulsed-power operations, or for shots that may release toxic material.

For specific details of clearance plans, see Area-specific SOPs for Clearance and Firing Operations.

It is strictly forbidden to pass any barricade or roadblock. Visitors encountering these should return to the Access Control Office or Local Access Office or wait until the restriction is removed. Travelers should check with the Local Access Office before starting.

6.2 Smoking, Matches, and Flame-Producing Devices in Firing Areas

- No one may take matches, lighters, or other flame-producing devices into the firing areas. Matches and lighters must be left at the Access Control Office at R183 or at TA-22. At TA-39, a box is provided at the gate for these items. At TA-14, they are left at the DX-2 Group Office.
- Exceptions are discussed in DX-4 SOP "General Safety."

6.3 Fire Department Notices

- Fire Department notices for Firing Operations are given by the Access Control Office at TA-15-183, for every firing site.

- Fire Department access procedures are specific to individual firing sites and are discussed in Site-specific SOPs.

7.0 PROCEDURAL STEPS

7.1 General Access Requirements

- Access Control Personnel administer access into the firing areas. They instruct visitors on site hazards, make arrangements for enhanced visitor training for off-road access, oversee visitor orientation, and issue the required exchange and dosimetry (TLD) badges. Access Control Personnel appropriate matches, lighters, and other flame-producing items. Access Control Personnel may issue radios or cell phones to visitors who might otherwise be out of communication with firing site staff, allowing personnel in firing areas to be located or warned when firing or other hazardous operations are about to begin.

- Access to TA-15 and TA-36, and visitor access to TA-39 sites is via the Access Control Office, located at TA-15-183. TA-40 Firing Sites are administered by the DX-1 Group Office at TA-22-90. Access to TA-14 is via the DX-2 Group Office at TA-9-21.

- Safety orientations will be given to all visitors entering Firing Areas, to inform them of special rules. Details vary from area to area. The orientation need only be given once a year to each particular visitor, but may be requested at any time. The visitors register is signed for every entry and exit. Access Control personnel will retain records of orientation.

- Fire department access to firing areas must be controlled to avoid exposing the firemen to explosive hazards, but access must be rapid in case of a fire. The Access Control Office at R183 will communicate with and advise the Fire Department when they are needed, and arrange for access to be available and safe. Access Control at TA-15-183 will be notified of emergency Fire Department activities.

- Exchange badges are issued by Access Control Personnel to personnel crossing certain boundaries. Exchange badge systems may serve a variety of functions; badges may be used as a counting system to locate personnel, they may serve as a token that specific training has been received or RADCON requirements have been met, or they may bear necessary keys, and denote who has these keys.

- When exchange badges are used, they are received upon every entry and exchanged immediately upon exiting from a firing area. Exceptions may be granted by he DX-4 Group Leader in Area III under special circumstances when there are no explosive operations planned for an extended period.
- The DX-4 Group Leader may establish deviations from normal exchange badge policy.
- Uncleared personnel shall be escorted into all areas. L-Cleared personnel shall be escorted into all Q-Cleared areas. Neither uncleared nor L-Cleared personnel will be issued exchange badges. DoD clearances are treated on a case-by-case basis.
- Special keys are found on visitor exchange badges. These keys unlock access gates. **These keys must not be removed from the exchange badges.**
- Perimeter gate keys are controlled by the Access Control Office at TA-15-183. Perimeter gates and barricades are listed in Attachment 1, "Site Description."
- The Access Control Office will be manned after hours for explosives operations at all sites, and in Area III, for A Minor radiation operations if visitors are present. After hours, hazardous operations in any area require Access Control at TA-15-183 to be informed before the close of business (4:00 PM), so that a central point of contact exists for informing all emergency personnel or other traffic in the area. Any visitors remaining at TA-15 or TA-36 firing areas will inform the Access Control Office before 4:00 PM, and make appropriate arrangements for recovering their regular technical badges from the exchange badge rack. The TA-22 DX-1 Group Office will inform the TA-15-183 Access Control Office of any personnel conducting hazardous operations at TA-40 after hours. Personnel conducting hazardous operations at TA-39 after hours will inform the Access Control Office before the close of business.

7.2 Visitors

All visitors must report to the Access Control Office or to the proper Local Access Office (TA-9, TA-15, TA-22, or TA-39) for permission to enter firing areas.

7.2.1 Access Control Office at R183

- Normal working hours at TA-15-183 are 8:00 AM - 4:00 PM. Work after normal working hours needs to be arranged through Access Control.
- Before entering the firing area for the first time, visitors will receive safety instructions, read a visitor orientation packet, and sign the visitor information sheet to certify that they have read and understand the information. They must also sign the visitor log book on each entry and departure.
- Persons holding a Secret-National Security Information (SNSI) security badge will be given permission to enter firing areas on a case-by-case basis to assure that they have the appropriate sigma levels.

7.2.2 Tours

Tours of a firing area are not given while firing operations or other hazardous operations are in progress in that area. Shot Observation is not considered a tour. The DX-4 Group Leader or ES&H Officer may waive any Exchange Badge requirement for tours involving a large number of people. In such cases, the escort will have a pictured exchange badge where required, and will report the number of people in the tour to the Access Control Office, where appropriate information will be attached to the escort's technical badge.

7.2.3 Shot Observation List

A person on site solely to passively observe a shot is classed as a visitor. Shot Observation does not constitute a tour. Observers will be escorted, and their presence at the observation point will be checked against the Shot Observation list at appropriate times.

7.3 Vehicle Access

It is strictly forbidden to pass any barricade or roadblock. Visitors encountering these should return to the Access Control Office or Local Access Office or wait until the restriction is removed. Travelers should check with the Local Access Office before starting.

The Lead Clearance Patrolman and the Firing Leader are authorized to restrict any travel that would affect personnel safety or would delay any firing operation.

7.4 Emergency Procedures

7.4.1 Building or Site Emergency

If an emergency situation should occur, follow the Building Emergency Plan (BEP)/Site Emergency Plan (SEP). The BEP/SEP must be available in the building and the operators shall be familiar with its contents.

7.4.2 Personal Injury

In any emergency involving injury to a person or persons, the employee encountering the accident should use good judgment on the procedures to be followed, depending on the circumstances. Decisions made by a DX Division employee at the scene of an accident will be supported by the DX Division management.

If there is a serious injury or accident, dial 911, aid victims, direct emergency vehicles, notify the Group Office, record accident details.

8.0 REQUIRED RECORDS

- Daily Visitor Log.
- Visitor and Training Databases.
- Visitor Information Sheet.

9.0 REFERENCES

- *DOE Explosives Safety Manual.*
- Los Alamos *Environment, Safety, and Health* Manual, AR 6-6, "Explosives."
- DX Division Operations Manual

10.0 ATTACHMENTS

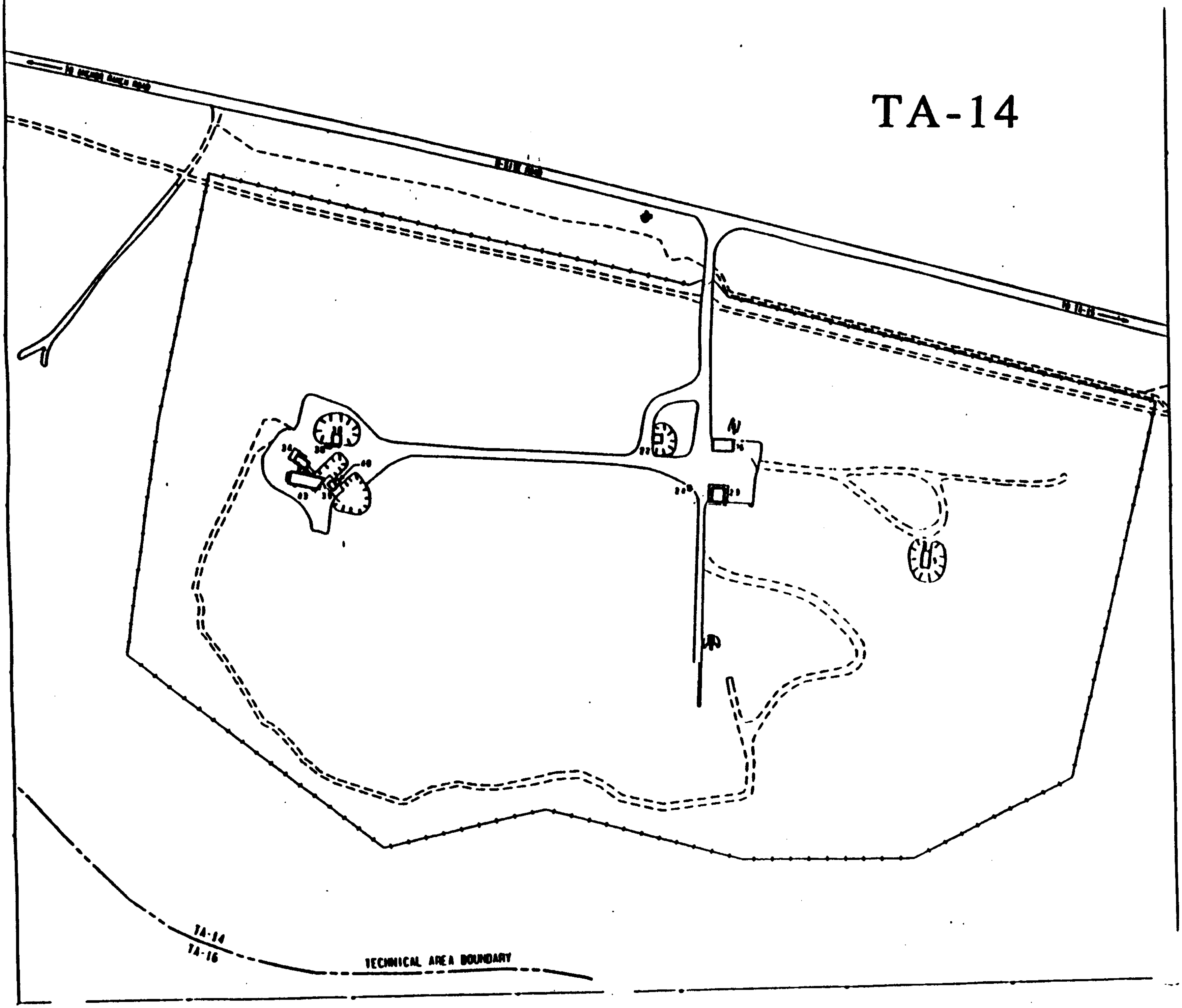
ATTACHMENT 1. Maps and Site Descriptions

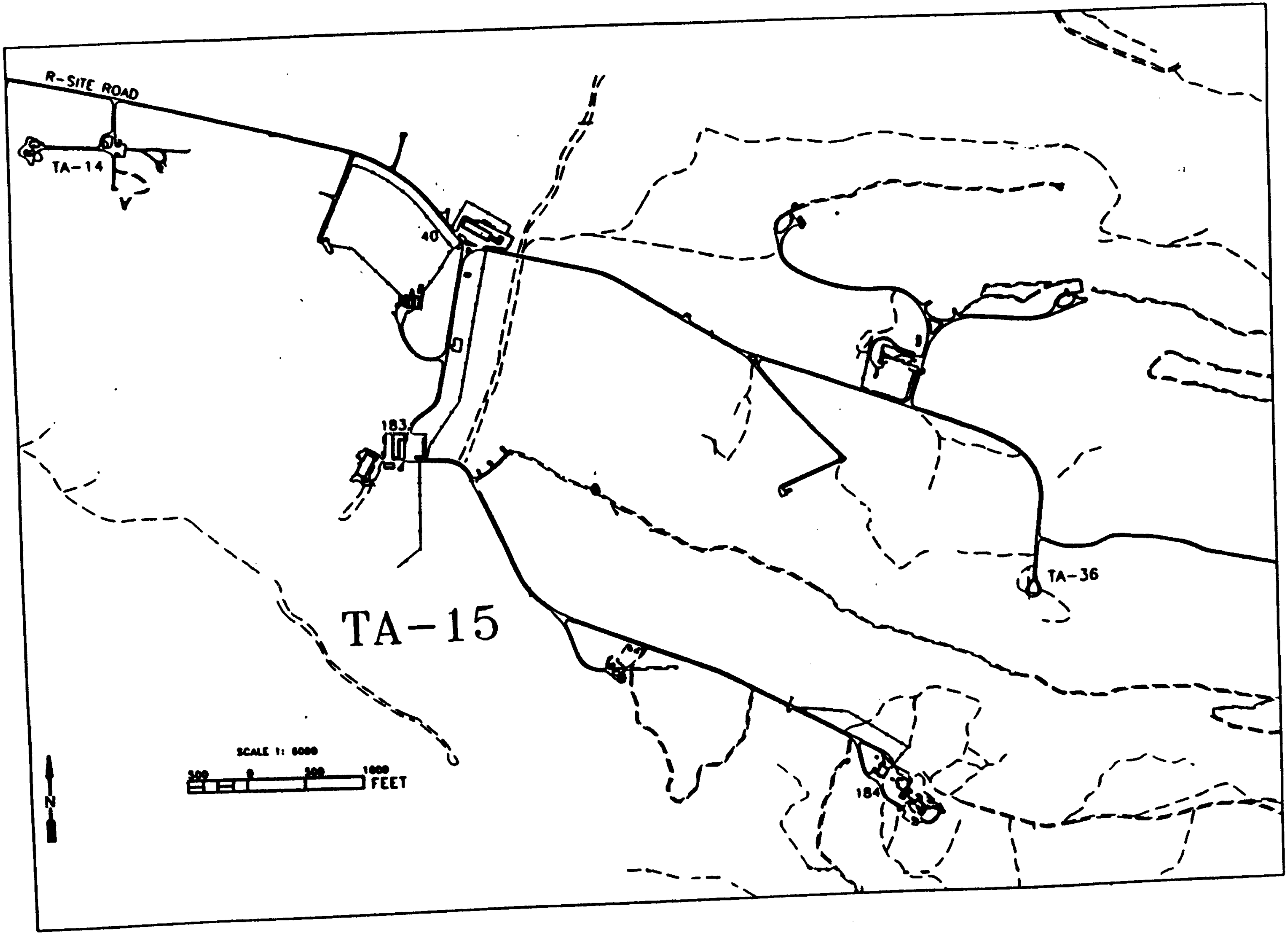
ATTACHMENT 1

Site Descriptions:

DF Site TA-40	Encompasses firing areas at the end of Two Mile Mesa.
Ancho Canyon TA-39	Encompasses firing sites at the head of Ancho Canyon, north of State Road 4.
Q site TA-14	The outdoor chemical laboratory associated with TA-9, and located halfway between TA-9 and TA-15.
Potrillo Canyon	Potrillo Canyon separates K-I and Area III. The power line runs down Potrillo Canyon. The canyon starts east of R-243, runs east between K-I and Area III, passing south of IJ Point and north of PHERMEX, and exiting at Eenie Site.
Area K-I:	Encompasses Kappa Site (TA-15), and the area previously known as Area I, situated on the northern part of R-Site (TA-15) mesa east of the safety fence, where five firing points are located.
Area III:	The south leg of R-Site (TA-15) mesa where the PHERMEX firing site is located. It includes all of the mesa leg east of the safety fence with the north, east, and south bounded by canyon rims.
Redondo Road:	Road west of R40 and leading northeast from its intersection with R-Site Road (link between TA-9 and TA-15). Redondo Road is closed with a chain. Redondo Road provides access to TA-67, formerly called TA-12.
Ridge Road:	The road leading from the immediate vicinity of IJ firing point at TA-15 to Kappa Site, TA-36.
IJ Road:	The road leading from the intersection near R306 to IJ Point, at TA-15.
Jumbo Road:	A dirt road between Eenie Site, TA-36, and the PHERMEX firing point.
Water Canyon:	Located south of R-Site (TA-15) and bordered by State Route 4, on the east and TA-49 on the south. The Access Control Office in TA-15-183 controls access to Water Canyon.

TA-14




R-SITE ROAD
TA-14
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183
TA-15
TA-36
184
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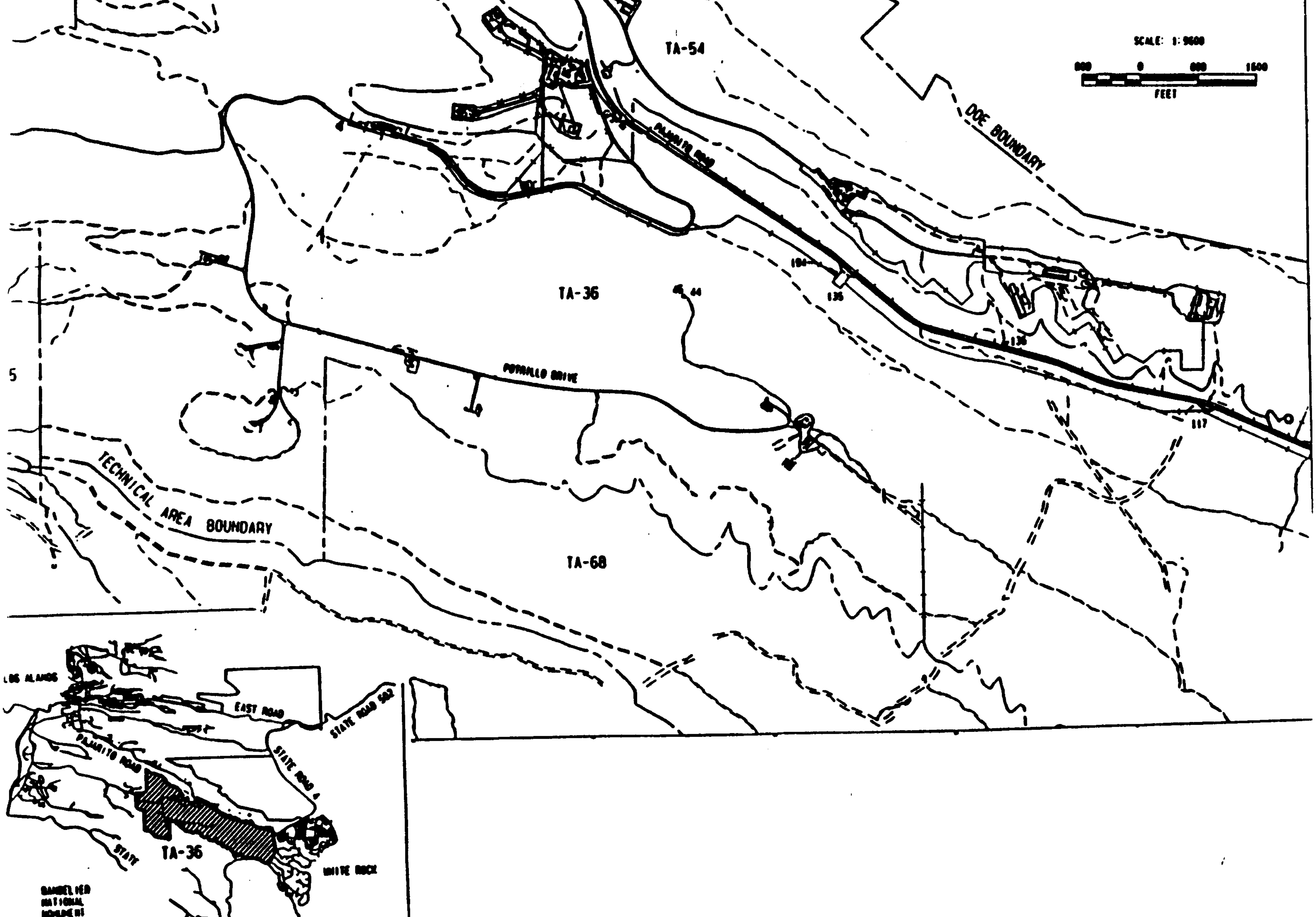
0
500
1000
FEET
N

TA-36



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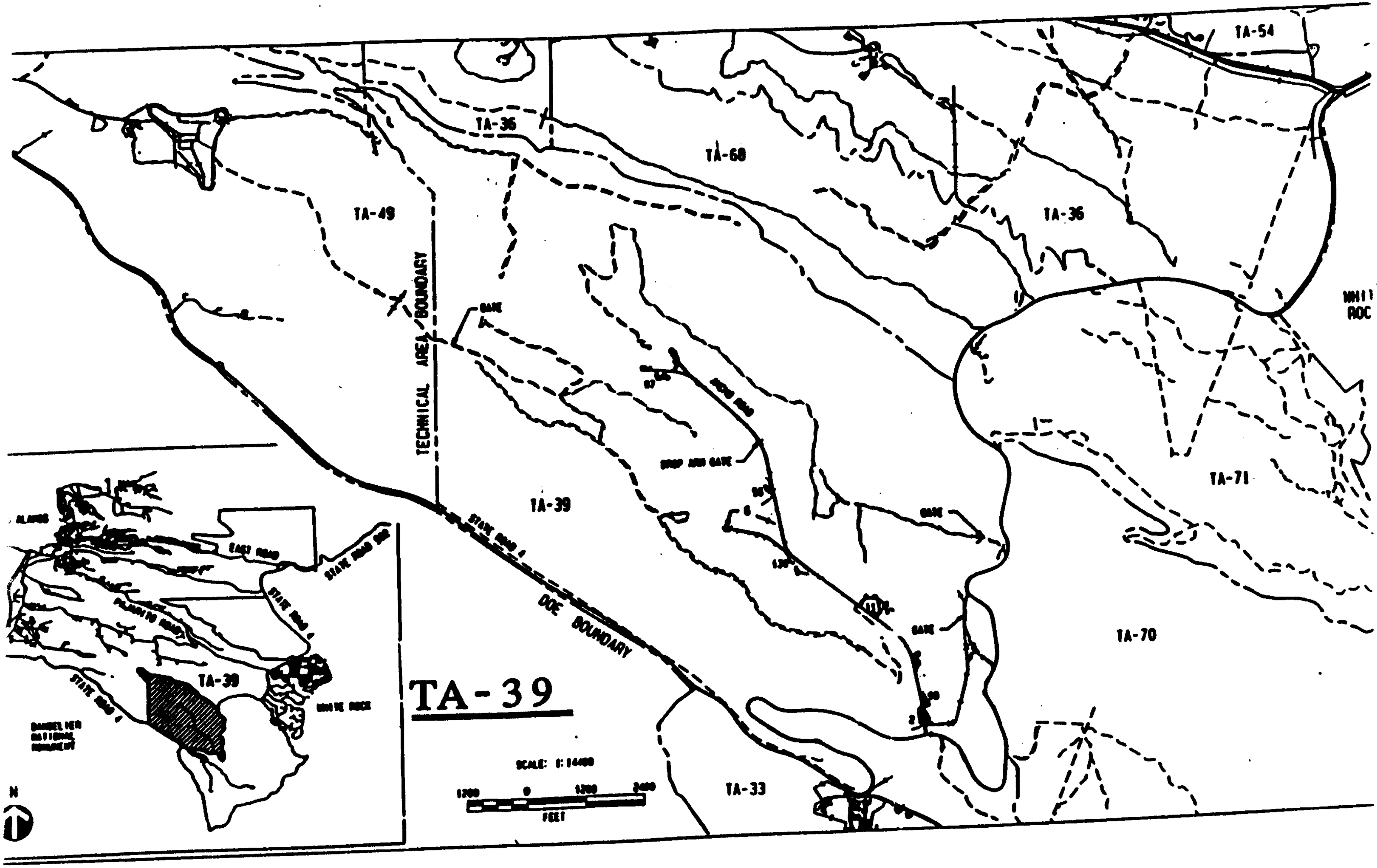
800
1600
FEET
TA-18
TA-54
TA-36
TA-68
DOE BOUNDARY
PAJARITO ROAD
PAJARITO DRIVE
TECHNICAL AREA BOUNDARY
117
LOS ALAMOS
EAST ROAD
STATE ROAD 502
STATE ROAD 4
PAJARITO ROAD
TA-36
WHITE ROCK
BANDELIER
NATIONAL
MONUMENT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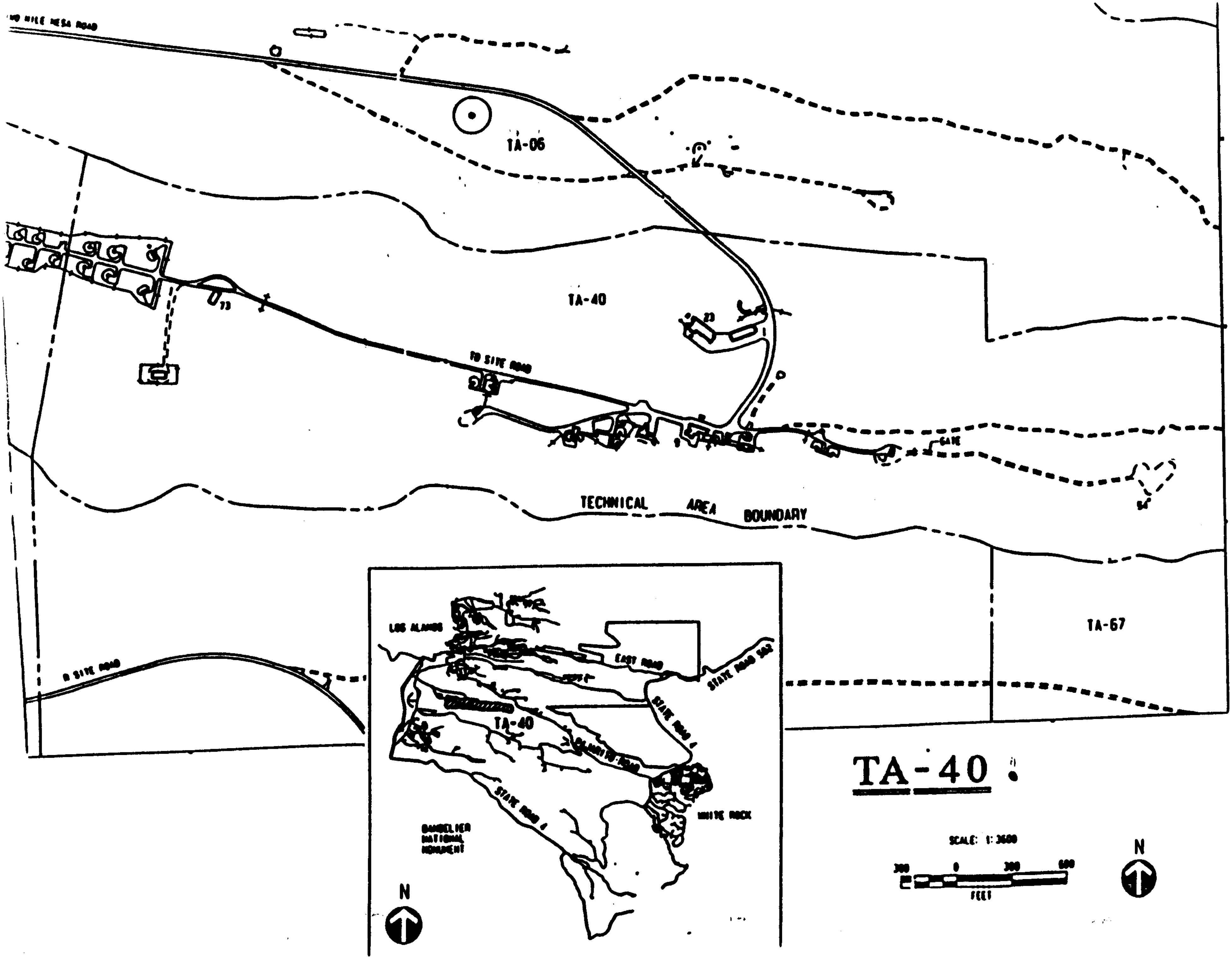
DOE BOUNDARY
STATE ROAD 4
TA-49
TA-36
TA-68
TA-36
TA-39
TA-33
TA-70
TA-71
TA-54
WHIT ROC
GATE
DROP ARM GATE
ALAMOS
EAST ROAD
STATE ROAD 4
STATE ROAD 502
PAJARITO ROAD
TA-39
WHITE ROCK
BANDELIER NATIONAL MONUMENT


TWO MILE MESA ROAD
TA-06
TA-40
TD SITE ROAD
GATE
TECHNICAL AREA BOUNDARY
TA-67
R SITE ROAD
LOS ALAMOS
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STATE ROAD 502
STATE ROAD 4
TA-40
WHITE ROCK
BANDELIER NATIONAL MONUMENT
N
TA-40
SCALE: 1:3600
300 0 300 600
FEET
N

DX-4

STANDARD OPERATING PROCEDURE

FOR

GENERAL SAFETY

SOP 3

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Controlled Document Number:

TABLE OF CONTENTS

1.0 INTRODUCTION

At Los Alamos, the group's primary mission is to support experimental research and development and application of explosives for the Los Alamos Nuclear Weapons Program and other customers. We provide the safety envelope, operational expertise, and experimental facilities for all explosives firing operations in the Division.

2.0 PURPOSE

This SOP is one of the series of DX-4 SOPs that provides necessary information, describes the hazards, and specifies safety procedures for all the areas and operations under the purview of the Field Operations and Experiment Support Group, DX-4. The purpose of this SOP is to provide general information and to identify the general hazards to which personnel may be exposed and to specify ways to minimize these hazards. This document provides part of the common reference material and the basic procedures and protocols that are part of ensuring a safe working environment.

3.0 SCOPE

This SOP is applicable to all personnel who frequent the areas listed below, or who are authorized to perform explosives firing operations at the areas operated by DX-4. These Explosives Firing Areas are described below and identified on the Maps attached as Figure 1:

- Area 3 (R-Site) includes the area East of the access gate near Building TA-15-40 (R-40), and the areas East of Building TA-15-183 (R-183).
- K1 (Kappa Site) includes all DX Division areas between the R40 gate and the east gate.
- TA-39 (Ancho Canyon) includes all areas North of the firing area access gate (but excludes the gas gun building 69 and support buildings 56 and 89).
- TA-40 (DF Site) includes all TA-40 DX-4 facilities South of Buildings 1 and 23.
- TA-14 (Q-Site) includes TA-14, Q-Site buildings

This SOP applies to all personnel, operations, and equipment involved in these experimental areas.

4.0 DEFINITIONS

- **Access Control** -- Access Control is guided by the General Access Control SOP 1.0. Access Control is governed by the Access Control Office, and by Local Access Offices. The Access Control Office in TA-15-183 administers access into firing areas at TA-15, TA-36, and TA-39, and oversees the exchange badge process and controls visitor access into these firing areas. Access to TA-40 is administered by the DX-1 Group Office at TA-22-90. Access to TA-14 is via the DX-2 Group Office at TA-9-21. Access to TA-39 is also handled through the Administrative Office at TA-39-2.

- **Access Gates** -- Gates or chains that can be locked. The keys are administratively controlled by the Access Control Office and Local Access Offices.
- **Area K-I** -- Kappa Site Area I includes R-306 at TA-15, all (five) firing sites at TA-36, and the northern part of R-Site mesa east of the safety fence.
- **Area III** -- Encompasses the south leg of R-Site mesa where the PHERMEX firing site is located. It includes all of the mesa leg east of the North-South-running safety fence with the north, east, and south bounded by canyon rims.
- **Authorizations and Assignments Document** -- A DX Division document that lists those individuals with special authorizations and/or assignments in the areas of explosives firing operations, firing area access, general industrial safety, special operations, and other areas of ES&H.
- **Barricade** -- A portable device, such as a sawhorse, with an appropriate sign, used to halt traffic into an area that is hazardous or is about to become hazardous.
- **Clearance Plans** -- Procedures that protect personnel within the firing areas by controlling access during explosive experiments, radiographic operations, or other potentially hazardous operations. The level of the clearance plan determines the control procedures to be followed, and the extent of the cleared area.
- **Cleared Area** -- An area that has been physically patrolled by a person performing assigned duties, or an area in which all personnel have been accounted for. A Cleared Area has been declared safe for firing operations to proceed.
- **EED** - Electroexplosive Device
- **ERC** - Explosive Review Committee
- **ES&H** - Environment, Safety, and Health
- **Escort** --
  During hazardous operations, an escort is defined as a Knowledgeable Person, who is familiar with procedures and operations in the firing areas and who assumes responsibility for the safety of assigned visitors at the firing site.
  During non-firing operations, escort refers to a Q-cleared person accompanying a non-Q-cleared person in secure areas.
- **Explosives** -- Explosives are defined in the *DOE Explosives Safety Manual* as any chemical compound or mechanical mixture that will burn or explode if heated, exposed to impact, pinched between moving surfaces, or subjected to an electric discharge or strong shock. The term applies to materials that either detonate or deflagrate. Because explosives do not all behave in the same way, they are divided into classes. Those of most interest to DX Division are initiating, boostering, and bursting-charge (secondary) explosives, propellants, and some types of military ammunition. A list of approved explosives is given in Attachment 1.
- **Explosives Allowed Area** -- Any area where explosives or explosive-containing components are stored, manipulated, prepared, or set-up for firing.
- **Explosives Excluded Area** -- An area where no explosive, explosive contamination, or operations with explosives are allowed. Generally, these are firing and diagnostic bunkers, offices, and buildings not specifically designated for explosives use or operations.
- **Firing Areas** -- The areas where firing operations are conducted. Access to these areas is controlled administratively and by an area Access Gate. These areas are Area K-I, Area III, TA-40 Firing Area, TA-39 Firing Area, and TA-14.

- **Firing Keys** – Strictly controlled keys that unlock firing circuits.
- **Firing Leader** – A full-time DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This person's accumulated knowledge and experience are crucial to all explosives firing operations.
- **Firing Mound** – Firing mound refers to the sand pile or steel firing pad on which the shot assembly is placed.
- **Firing Point or Site** - The actual location of an explosive test and its exclusion area behind the appropriate safety gate.
- **Hazard Circle** – A region, not always circular in shape, that is evacuated in a clearance plan because shrapnel from the shot is expected to land within that region. May also be called a hazard zone or a fragment area. However, the definition of a hazard circle is only a guideline, fragments occasionally land outside of them.
- **HE** – High Explosive
- **Knowledgeable Person or Employee** – A person, designated by the DX-4 Group Leader or the Deputy Group Leader, deemed eligible for a pictured exchange badge because of specified training and experience. All other personnel are visitors. All required reading, institutional training, and OJT requirements must be completed before becoming a knowledgeable person or employee. These requirements are specified in Site Specific SOPs or the Authorizations and Assignments Document.
- **Local Access Office** – Access to TA-14, TA-39, and TA-40 is governed by Local Access Offices at TA-9, TA-39, and TA-22, respectively. These offices supplement the Access Control Office, and handle some visitor access. (See Access Control.)
- **Low Energy EEDs** – Hot-wire initiators, squibs, blasting caps, etc.
- **Pictured Exchange Badge** – A badge bearing the employees picture, given to employees who are knowledgeable in operations and procedures.
- **Primary Explosives** – Explosives with a sensitivity greater than PETN
- **Safety Fence** – A fence placed to indicate a separation of areas, usually a supplement to, and continuation of, a safety gate or an access gate.
- **Safety Gate** – A gate that marks the entrance to a Firing Point. The last gate before hazard is encountered, the safety gate may be interlocked.
- **SOP** – Standard (or Safe) Operating Procedure
- **SWP** – Special Work Permit
- **Visitor's Badge (V Badge)** – A badge bearing a "V" instead of a picture, to be given to visitors who are not knowledgeable in local operations and procedures, but have received site-specific training.
- **Visitor** – a person in a firing area who has not met the requirements for a "Knowledgeable Person."

  Escorted – Visitors who have not received site-specific training or are unfamiliar with operations, or who lack a Q clearance, and are escorted into firing areas.

  Unescorted – A visitor who has received site-specific access orientation, and a Visitor's Badge, and may be in a firing area unescorted when no firing operations are in progress.

5.0 RESPONSIBILITIES

The responsibilities described below are common to all DX-4 SOPs.

5.0.1 All Employees

By Laboratory policy, the primary responsibility for ES&H rests with line management. However, the individual employee is the one best able to assure his or her personal safety. Employees must not undertake any operation they believe will be unsafe or contribute to an unsafe condition; rather, they must report such to their line supervisor or ES&H Officer who will resolve the concern or seek further guidance from line management.

Urgency is never an excuse for performing an unsafe operation or violating an ES&H rule. Line supervisors are responsible for establishing a safe work environment; the employees, in turn, must follow all ES&H rules for their own safety and the protection of their fellow employees and the environment.

5.0.1.1 All individuals should comply with the SOPs governing any activity in which they are engaged. Ignorance of the contents of an SOP does not excuse any violation. Any confusion regarding an SOP should be clarified before an operation begins.

5.0.1.2 All Employees are encouraged, at all times, to suggest changes to an SOP or procedure. For example, a change might make an SOP easier to read, or an operation safer or more efficient.

5.0.1.3 In situations where an approved SOP cannot or should not be strictly adhered to, the SOP must be revised or a deviation be formally approved (i.e. SWP). Violations of SOPs (or any other action which jeopardizes safety), whether willful or unintentional, cannot be tolerated and must be reported to the Group Leader for appropriate action. If a violation is committed by someone other than an DX-4 employee, that person's organization will be notified by the Group Leader.

5.0.2 Supervisors

Each line supervisor must know the SOPs that apply to operations under their control and will be responsible for assuring that these SOPs are kept current and enforced.

5.0.3 Firing Leader

The Firing Leader shall have immediate responsibility for the operational safety of an operation, and shall be the final authority on questions of safety and procedure during operations at a Firing Point. Also, the Firing Leader is:

- Knowledgeable about group SOPs and operations.

- Responsible for selecting or confirming the choice of the appropriate clearance plan (hazard circle) for the shot, based on details of the experiment.
- Responsible for overseeing the safety of the firing crew, other personnel, equipment, and facilities at the firing site. Responsible for the safety and security of the firing operations.
- Responsible for personnel control on the firing mound or in the firing chamber.
- Shall not permit firing until all personnel within the hazard zone of the shot are in safe shelters, or are removed from the hazard zone.
- Responsible for firing keys during firing operations.
- Ensures that safety and operational equipment is used properly.
- Participates in inspections; ensures that any defects found during routine maintenance and inspection are corrected by the appropriate personnel.
- Assists in critiques and accident investigations; reports occurrences.
- May delegate some responsibilities to authorized personnel.

5.0.4 Knowledgeable Persons

Knowledgeable Persons shall obey the safety and security procedures for firing operations, obey access control and clearance procedures, and assist others in the proper conduct of firing area operations. Knowledgeable Persons must exhibit personal ownership of working areas and, if there are any ES&H concerns, take personal responsibility to see that proper actions are requested and implemented. Knowledgeable persons may escort visitors.

5.0.5 Unescorted Visitors

Unescorted visitors shall have a Q-clearance, obey all aspects of the site-specific access orientation, and stay in communication with Access Control by cell phone or radio. Unescorted visitors will be given V badges for entry to TA-15, -36, -39, and -40. Specifics of access will be determined by the Access Control Office and Local Access Offices. Unescorted visitors may escort Escorted Visitors.

5.0.6 Escorted Visitors

Escorted Visitors shall obey and stay with their escort at all times while in a firing area.

5.1 Required Reading

5.1.1 Each employee must read all the SOPs that apply to their job at the time of their assignment and yearly thereafter. Revisions to the SOPs must be read prior to performing the operations described.

5.1.2 Line supervisors will be responsible for determining which SOPs are required for their employees.

5.2 Training

5.2.1 The line supervisors are responsible for on-the-job-training, documentation of that training, detailed instruction, and monitoring of the operators' competence and adherence to instructions.

5.2.2 Explosive operations shall be performed only by personnel with proper training and supervisory approval.

5.2.3 All training is to be in accordance with the DX Division Training and Qualifications Manual.

5.3 Waste Minimization

5.3.1 Waste minimization will be handled according to the Waste Minimization section of the DX Division Operations Manual and the LANL ES&H Manual, AR 10-8.

5.3.2 Waste generated from operations must be reduced as much as technically and economically feasible. To meet this objective, the waste minimization practices of material substitution, good housekeeping, and hazard segregation must be incorporated into all waste generating activities. All waste generators are responsible for making every practical effort to reduce the amount of waste produced.

5.3.3 All waste will be handled according to the DX Division Waste SOP and the LANL ES&H Manual, AR 10-3.

6.0 PRECAUTIONS AND LIMITATIONS

Precautions: The general hazards associated with DX-4 operations include mechanical equipment (from hand tools to mobile cranes), electrical sources (wall outlets to high voltage capacitors and power supplies), laser and X radiation, DU or other radioactive materials, chemicals, and, foremost, high explosives. The precautions and limitations for each of these hazards are given in the SOPs that cover particular operations or locations. Because explosives are the common element of most DX-4 operations, the precautions and limitations for their use are detailed here.

6.0.1 The hazards associated with explosives and explosive devices are blast, fragments, violent deflagration, and possible toxicity.

6.0.2 Explosives are energetic materials that can react violently. Explosives will be protected from abnormal stimuli or environments, including:

- friction forces
- excessive pressures
- impact, shock, pinching

- deformation
- electrical sparks, abrasive or welding sparks, open flame
- contamination
- excessive temperature

6.0.3 An approved SOP/SWP shall be available before any explosives operation is performed. Such SOPs/SWPs shall be readily available in the work areas to which they apply.

6.1 Housekeeping and Personnel Hygiene

Housekeeping in all areas shall be maintained at extremely high levels. Aisles, corridors, and safety exits shall not be blocked.

6.1.1 Spilled explosives shall be cleaned up immediately, then, if necessary, disposed of according to the DX Division Waste Management SOP.

6.1.2 In addition to being an explosive hazard, explosives also are a possible toxic hazard, with respect both to inhalation and to contact with the skin. Some people are more sensitive than others and can for example develop a skin rash, or get headaches from the nitroglycerin in propellants. For these reasons, personnel shall maintain a high degree of personal hygiene by washing their hands after handling explosives, especially before eating or smoking.

6.1.3 Personnel handling explosives shall visually check their work clothing to be sure no explosives are carried from an explosives area to a non-explosives area. Personnel shall not consume any food or drink item in any Explosives Allowed Area.

6.1.4 All maintenance and custodial personnel shall be cleared into any explosive area prior to any maintenance work. The DX-4 SOP governing Custodial and Maintenance Activities in Firing Areas discusses the procedures and limitations to be followed by all personnel doing such work. The removal of any equipment from an explosives work area shall meet the requirements of this SOP. Maintenance work in an Explosives Allowed Area may require an SWP.

6.1.5 Use of flammable solvents in an explosives area considerably increases the explosive hazard because of the ease-of-ignition of the solvent with a possible spread of fire to explosives. Therefore, solvent use and evaporation shall be kept to a minimum. Solvent use will take place in well-ventilated areas, and with proper personal protective equipment.

6.2 Hearing Protection

Hearing protection must be provided at all operations where there is a potential for hearing damage, and must be worn when appropriate.

6.3 Barricades, Gates, and Warning Signs

It is strictly forbidden to pass any barricade, closed gate, or warning signs.

Typical warning signs are indicated below. All personnel are required to obey the restrictions indicated by any sign in all areas. A warning sign near the firing mound can read:

DANGER
EXPLOSIVES
Return to lights if horn or siren is sounding.

A warning sign used for barricading an access road during a clearance procedure can read:

DANGER
KEEP OUT
High-Explosive Operations in Progress

A warning sign used for barricading an access road during a radiographic operation can read:

DANGER
KEEP OUT
X-Ray Operation in Progress

6.4 Warning Lights, Horns, and Sirens

The particular sequence of lights, horns, sirens, and pauses differs in detail at the various firing sites. An exact description of the horn-siren sequence for a given Firing Point is found in the Site-Specific SOP for that Firing Point. In general:

- Horns sounded alone (and flashing lights where installed) indicate an experiment will commence in the next several minutes. All personnel should be under cover or at a safe distance. If not, they should seek safe shelter or distance immediately.
- A siren sounding for more than 30 seconds indicates that explosives will be fired within a few minutes. All personnel should be under cover or at a safe distance.
- A sequence of at least two short siren soundings indicates an "All Clear" or safe condition now exists on the Firing Point.

6.5 Radio Communication

Communication on the DX Division radio networks shall be brief, necessary, and unclassified.

6.5.2 Multiple Division Radio Nets

There are several frequencies available for DX Division operations. All of the nets are accessible from Division radios. A list of the net names, call signs, frequencies, and normal use areas is given in Attachment 4.

6.5.3 Use of Radios During a Test or Experiment

There is free-channel radio communication among all firing bunkers, vehicles used for clearance operations, the Access Control Office, the Group Office, several offices of DX Division, and Division members whose expertise is often needed during shot operations. During the time that the firing circuit is unlocked, the radio should be reserved for communication concerning the shot being fired and emergencies.

6.5.4 Restrictions

Handheld radios and mobile RF transmitters (e.g., cell phones) are generally allowed for use within the Explosives Firing Areas. However, in areas where low energy EEDs are stored or used in assemblies or test devices, special control must be exercised. Likely restricted areas include:

- TA-22-34
- TA-22-93
- TA-22, all magazines
- TA-40-5, 6, and 7
- TA-36-11, 12

6.5.4.1 Whenever low energy EEDs are present, it shall be the responsibility of the authorized Firing Leader in the potentially restricted areas to inform the appropriate access control personnel that all RF transmitters in these areas are prohibited. This will be accomplished by informing access control personnel in the TA-22 (DX-1) Group Office, the R-183 Access Control Office, or the TA-39 Administrative Office, who will then restrict visiting personnel from using RF transmitters. Further, operators will place signs on all routine entrances to these areas informing personnel to turn off all RF transmitting devices before entering these areas. The Firing Leader will assure that all personnel within the restricted area are informed of the prohibitions.

6.7 Motor Vehicles

All motor vehicles shall be operated with extreme care, particularly when approaching or leaving the Firing Points, or while in the proximity of placarded explosives-carrying vehicles. Vehicles authorized to carry explosives will comply with all the requirements of the DOE Explosives Safety Manual.

Limitations:

6.8 Requirements for Documentation

An approved SOP/SWP shall be available before any explosives operation is performed. Such SOPs/SWPs shall be readily available in the work areas to which they apply.

6.8.1 A hazard assessment must be written for every new, proposed testing program or new process so that all foreseeable hazards involved may be examined. This shall be done by the most knowledgeable person involved in the test or process with the advice and consent of the Division ES&H Committee, as appropriate. All SWPs will be written and approved according to the process given in the DX Division Writers Guide.

6.9 Approved Explosives and Glues

All explosives or explosive-containing devices that have been approved by the ERC or listed in (ESA) WX-3: SOP 1.1.0, Tables 1 & 2 may be used at DX-4. Attachment 1 is a list of HE routinely used at DX-4, and Explosives in (ESA) WX-3: SOP 1.1.0.

6.9.1 No explosive powders or primary explosives will be handled at DX-4 without prior approval or appropriate SOPs/SWPs.

6.9.2 A list of approved glues for use with identified explosives is given in Attachment 2.

6.10 Control of Access Through Firing-Area Gates

DX-4 knowledgeable personnel and other knowledgeable personnel gain access to the firing areas by using administratively-controlled keys. All other individuals must clear through either the Access Control Office (for TA-15, TA-36, and TA-39), the DX-1 Group Office (for TA-40), the DX-2 Group Office (for TA-14), or the Administrative Office at TA-39 before they will be allowed access to a firing area. Qualified Office personnel instruct visitors on the site hazards, have them read the appropriate visitor information, and enter their names in a log. Access Control Procedures are discussed in detail in DX-4 Access Control SOPs, including "General Access Control."

6.11 Working Alone

DX-4 employees with current safety training and experienced in explosive operations may work alone under appropriate circumstances, such as assembly, measurement, gluing, inspection, and clamping of certain consolidated explosives and explosive devices.

6.11.1 This working alone procedure authorizes personnel to work alone in DX-4 HE operations. When working alone with HE, employees will use a procedure appropriate for the particular work area. These procedures require Access Control, Local Access Office, or a coworker to have the following information:

- Who is working alone,
- Where they are located,
- How long they will be working alone (with a completion time).

6.11.2 All operations shall be performed in accordance with existing SOPs/SWPs. Personnel shall be assigned in a manner such that each worker's presence is frequently monitored for example via radio or physical check. New, special, or non-routine operations will require a separate assessment and an SWP.

6.12 Electrical Equipment

All operations shall be performed in accordance with LANL Electrical Safety Policies.

6.12.1 All permanent electrical equipment and wiring for those areas containing explosive hazards shall conform to the standards of National Electrical Code (NEC), Hazardous Locations, Class II or Class I & II (dual rated), as modified by the DOE Explosives Safety Manual.

6.12.2 Certain electrical equipment not rated NEC Class I or II is permitted for administratively controlled use within the Explosive Preparation Rooms. A list of those rooms is given in Attachment 3. The equipment listed in DX-4 SOP "General Firing Operations" is approved as intrinsically safe when used under the restrictions noted. No electrical equipment may be used unless it is considered NEC Class I or II or listed in "General Firing Operations."

6.13 Protective Clothing and Equipment

6.13.1 Eye Protection

It is a requirement that eye protection be worn at all times when there are eye hazards. Operations can involve a wide range of eye hazards making it difficult and impractical to categorize the type of eye protection necessary for each specific operation involved.

- Eye protection must be worn in all areas in which eye hazards are known to exist, whether working with explosives or not (e.g., machine shops, carpenter shops, operations involving chemicals). Eye protection may be removed only as required for use of optical and other inspection devices.
- All personnel entering posted eye hazard areas must wear the appropriate eye protection for that area, except as permitted below.
- The requirement for eye protection may be waived by the Group Leader or designee for persons who are included in a guided tour where operations have been suspended. The waiver may apply to a room, building, or to all buildings to be visited.
- Visitors, other than those described above, must wear the appropriate eye protection in the designated eye hazard areas. It is the responsibility of the person being visited to assure that the visitor is provided with the necessary eye protection.

6.13.2 Clothing

Generally, clothing provided by the Laboratory for the protection of employees (e.g., safety shoes, clothing for working out-of-doors, hard hats) should not be taken off the Laboratory premises. DX-4 employees are expected to wear appropriate and/or required protective clothing according to the operations being performed. Questions regarding requirements and best practices will be resolved by line management.

- Coveralls (without cuffs) or lab coats shall be worn, at all times, if a potential for explosive-contamination by dust or chips on clothing exists. Explosive-contaminated clothing shall not be removed from the Explosives Allowed Area except for final disposal.
- Certain SOPs or SWPs may require that non-sparking soles, conductive shoes or leg stats be worn, therefore a check of the SOP or SWP covering the operations shall always be made.
- Visitors shall wear shoe coverings if their footwear does not meet the requirements for workers in areas where they are visiting.

6.14 Explosives Load Limits

Each Magazine, Explosives Preparation Room, and Firing Point has a maximum limit on the amount of explosive that can be present during normal operations. These limits are generally expressed in terms of "Pounds (or kg) of TNT explosive equivalent." The limits for DX-4 facilities are listed in Attachment 5, and in the Firing-Point, Prep Room or Magazine SOPs.

6.15 Lightning

All operations involving explosives shall be suspended during electrical storms in accordance with the DOE Explosives Safety Manual. Personnel shall be cleared from the Firing Mound during this suspension.

6.16 Explosives Excluded Areas

No explosives-contaminated equipment may be moved to an explosive-excluded area. Every effort should be made to avoid moving explosive contamination to an explosives-excluded area.

7.0 PROCEDURAL STEPS

7.1 Emergency Procedures

7.1.1 In all emergencies, call 911. In the event of an emergency or incident, notify DX-4 management as soon as possible. Follow the DX Division Operations Manual, Section 10.3 to report any incidents or accidents.

7.1.2 The Building/Site Emergency Plan will be followed. It covers what to do, depending on the circumstance.

7.1.3 If a spill occurs, the Building/Site Emergency Plan will be followed, then the Waste Management Coordinators will be called.

7.1.4 In the event of eye damage, suspected eye damage, or tissue burns due to laser radiation, the source of injury shall be turned off or removed (as practical and safe), and the injured person taken to the Occupational Medicine Group (ESH-2) for treatment.

7.1.5 Any person receiving an electrical shock must report to the Occupational Medicine Group (ESH-2) for evaluation and/or treatment.

7.2 Handling of Explosives

The following general criteria apply to all operations that involve explosives:

- Handling of HE should be minimized.
- The distance that an item will fall if accidentally dropped must be minimized.
- Hard surfaces or sharp edges that could be struck by a bare piece of HE in the event of an accidental drop should be padded or otherwise protected.
- Floor areas where the handling of HE items is most likely to occur should be covered with an approved tile to reduce the danger in the event of an accidental drop.
- The work area surrounding an HE item that is to be handled shall be kept clear of extraneous tools, components, fixtures, and other impediments that could interfere with handling operations.
- The sliding of bare HE on surfaces should be avoided because HE surfaces are relatively susceptible to marring by scratching or slipping. This is important from a quality as well as from a safety standpoint.

- The stability of an item must be maintained during all operations. The operator must evaluate the forces that will be acting on an item during the operation. If the operational forces will result in an unstable or unsecured situation, alternate procedures must be developed. Any uncertainty or question should be directed to the line supervisor for appropriate action.
- After an operation on an item has been completed, the item must be placed in a secure location and left in a stable configuration. When possible, all items destined for storage or movement elsewhere should be placed in suitably designed containers. **An item must not be left in any position at any time where it can be easily toppled.**

7.3 Fires

In the event of fire involving or imminently threatening explosives,

Clear the area and report the fire. Do not attempt to fight any fire involving explosives in any DX Division explosive area.

7.3.1 Fire extinguishers at magazines are for the purpose of fighting small external fires.

7.3.2 Vehicle mounted fire extinguishers should be used on fires where explosives are not presently or imminently involved. Should a fire occur, an attempt to prevent the fire from spreading to the load should be made. If safe and possible, the explosives should be removed. If the fire presently or imminently involves the explosive load, evacuate all personnel to a safe distance. This distance should be at least 1,250 feet.

7.3.3 There shall be no smoking, except in designated locations. **No matches, lighters, or other fire, flame, or spark-producing devices shall be taken into an Explosives Allowed Area, except with written authorization (SWP).** There are electrical lighters provided at locations.

7.4 Personnel Authorizations

7.4.1 **Firing Leader** – The list of authorized Firing Leaders, and the Firing Points they are authorized for, is given in the Authorizations and Assignments Document. Only the Group Leader or Deputy Group Leader can authorize additions or deletions from the list of authorized Firing Leaders.

7.4.2 **Knowledgeable Personnel** have at least four months experience working in a firing area as verified or excepted by the Group Leader or Deputy Group Leader. Knowledgeable persons will meet the training requirements stipulated by DX-4. Persons will be designated as "Knowledgeable" when they are judged competent to perform safely in an authorized firing area. Each of the five firing areas requires separate authorization.

8.0 REQUIRED RECORDS

- Daily Visitor Log
- Visitor and Training Databases
- Visitor Information Sheet
- Authorizations and Assignments Document

9.0 REFERENCES

- DOE Explosives Safety Manual
- Los Alamos Environment, Safety, and Health Manual, AR 6-6, Explosives
- DX-Division Operations Manual
- DX-Division Electrical Safety SOP

10.0 ATTACHMENTS

Attachment 1. HE routinely used at DX Division Firing Areas
Attachment 2. Adhesives and Glues routinely used at DX Division Firing Areas
Attachment 3. DX Division Preparation Rooms
Attachment 4. List of the net names, call signs, frequencies, and normal use areas for radios.
Attachment 5: Load Limits for DX Division Facilities
Attachment 6: TNT Equivalent of some Common Explosives
Attachment 7: Definition of explosive contamination. Memo from the ERC.

Attachment 1

HE routinely used at DX Division Firing Areas

NORMAL EXPLOSIVES

All explosives or explosive-containing devices that have been approved by the ERC or listed in (ESA) WX-3: SOP 1.1.0, Tables 1 & 2 may be used at DX-4.

This list contains the names and identification numbers of all explosives and detonators approved for normal explosives operations. Explosives on this list may be received or handled by Group DX-4, unless a separate SWP or SOP exists covering the operations, or a request for limited tests is approved.

- **Primary explosives** - Explosives with a sensitivity greater than PETN (for example, lead azide, lead styphnate or mercury fulminate) are not used by DX-4 except with specially approved procedures.

SINGLE-COMPONENT EXPLOSIVES

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
AN	130LN	Ammonium nitrate	20 years
DATB	1201	diaminotrinitrobenzene	20 years
DINGU		Dinitroglycouril	
DINA		Di(nitroethyl) nitramine, dioxyethyl dinitrate	20 years
EDNA	1101	ethylenedinitramine, Halite	20 years
HMX	03NN	cyclotetramethylenetetranitramine, Octogen	20 years
LAX-112			
NM		Nitromethane	10 years in 55 gal drum
NQ	07NN	Nitroguanidine, Picrite	20 years
NTO		1.2.4-nitro-tiazole-5-one	
PETN	06NN	pentaerythritoltetranitrate	20 years
Picric Acid		1,3,5-trinitrophenol note: Picric acid forms impact-sensitive compunds with metal ions.	2 years
RDX	02NN	cyclo-1,3,5-trimethylene-2,4,6-trinitramine; Hexogen, Cyclonite	20 years
TATB	1701	1,3,5-triamino-2,4,6-trinitrobenzene	20 years
Tetryl*	04NN	2,4,5-trinitrophenylmethylnitramine	20 years
HNS	3001	Hexanitrostilbene	20 years

TNT	010N	2,4,6-trinitrotoluene; Trotyl	20 years

* Tetryl has greater toxicity and greater sensitivity to electric spark than the other permitted explosives

LIQUID EXPLOSIVES

Explosive	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
FEFO		1,1'-[methylene bis(oxy)]bis[2-fluoro-2,2-dinitroethane]	90 days
Nitromethane		NM, see also under single-component explosives	10 years in 55 gal drum

MIXED EXPLOSIVES INCLUDING CAST AND PRESSED FORMULATIONS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
ANFO		Ammonium nitrate/fuel oil	90 days
Boracitols		60 wt% boric acid/40 wt% TNT	20 years
Baratol	76NN	76 wt% barium nitrate/24 wt% TNT	20 years
Calcitol		40 wt% TNT/55–60 wt% $CaCO_3$/0–2 wt% talc/1–2 wt%, microballoons, X-0533	90 days

MIXED EXPLOSIVES INCLUDING CAST AND PRESSED FORMULATIONS, Continued

Plastic Bonded Explosives - Formed from one or more of the explosive compounds listed individually in "Single-component Explosives," above, mixed with binders and, in some cases, nonexplosive ingredients. Production forms of plastic bonded explosives are identified in numbered series denoted by the letter "PBX-" (originated by Los Alamos); "LX-" (originated by Lawrence Livermore); "EDC-" (originated by the United Kingdom); and "PBXN-" (originated by the US Navy). Also permitted are experimental plastic bonded formulations originated at Los Alamos and identified by the prefix "X-" and a four-digit number.

CH-6		97.5 wt% RDX/1.5 wt% calcium stearate/0.5 wt% polyisobutylene/0.5 wt% graphite	20 years
Comp. A			
Comp. A-2			
Comp. A-3	9085	9085, 91 wt% RDX/9 wt% beeswax	20 years
Comp. A-4		97 wt% RDX/3 wt% beeswax	20 years
Comp. A-5		98.5 wt% RDX/1.5 wt% beeswax	20 years
Comp. B	60NN	64 wt% RDX/36 wt% TNT, Comp B, Hexolite, Hexotol	20 years
Comp. B-3	60NN	60 wt% RDX/40 wt% TNT	20 years
Comp. C-3	9080	9080, 88 wt% RDX/12 wt% wax	20 years
Comp. C-4	9081	9081, 91 wt% RDX/2.1 wt% polyisobutylene/ 1.6 wt% motor oil/5.3 wt% di(2-ethylhexyl) sebacate	20 years
Cyclotol 75/25	750N	75 wt% RDX/25 wt% TNT	20 years
Cyclotol 70/30	700N	70 wt% RDX/30 wt% TNT	20 years
Detasheet C	6300	63 wt% PETN/8 wt% NC/29 wt% elastomeric binder	10 years
Detasheet D	6301	75 wt% PETN/25 wt% elastomeric binder NOTE: THIS MATERIAL IS USUALLY RED, BUT IT IS AN EXPLOSIVE, NOT AN INERT	10 years
EDC-8		76.0 wt% PETN/24.0 wt% RTV Silicone	20 years
EDC-28		94wt% RDX/6 wt% FPC 461	20 years
EDC-32		85wt% HMX/15 wt% Viton A	20 years
EDC-37			20 years
EDC-38			20 years
HBX-1		40 wt% RDX/38 wt% TNT/17 wt% Al/4.5 wt% wax/0.5 wt% $CaCl_2$	20 years
LX-04	LX04	85.5 wt% HMX/15.0 wt% Viton	20 years
LX-07	LX07	90 wt% HMX/10 wt% Viton	20 years
LX-10	LX10	95.0 wt% HMX/5.0 wt% Viton A	20 years
LX-14	LX14	95.5 wt% HMX/4.5 wt% Estane 5702-F1 (X-0282)	20 years
MDF		Mild Detonating Fuse	20 years
Nonel		RDX lined metal tubing	20 years
Octogen		94.5 wt% HMX/4.5 wt% wax/1 wt% graphite	20 years

Octol	740N	75 wt% HMX/25 wt% TNT	20 years
PBX 9001	9001	90 wt% RDX/8.5 wt% polystyrene (PS)/ 1.5 wt% dioctyl phthalate (DOP)	20 years
PBX 9007	9007	90 wt% RDX/9.1 wt% polystyrene (PS)/ 0.5 wt% dioctyl phthalate /0.4 wt % resin	20 years
PBX 9010	9010	90 wt% RDX/10 wt% Kel-F 3700	20 years
PBX 9011	9011	90 wt% HMX/10 wt% Estane-5703	20 years
PBX 9205	9205	92 wt% RDX/6 wt% polystyrene (PS)/ 2 wt% dioctyl phthalate (DOP)	20 years
PBX 9206	9206	92 wt% HMX/8 wt% Kel-F elastomer	20 years

MIXED EXPLOSIVES
INCLUDING CAST AND PRESSED FORMULATIONS, Continued

PBX 9404	9404	94 wt% HMX/3 wt% NC/3 wt% tris(b-chloroethyl) phosphate (CEF) note: PBX-9404 is unusually sensitive to certain types of impact, in particular, skidding.	1st period- 20 years, 10 years thereafter
PBX 9401	9401	94.2 wt% RDX, 3.6 wt% polystyrene, 2.2 wt% trioctyl phosphate	
PBX 9405	9405	93.7 wt% HMX, 3.15 wt% nitrocelulose, 3.15 wt% tricloroethyl phosphate	20 years
PBX 9407	9407	94 wt% RDX/6 wt% Exon-461	20 years
PBX 9501	9501	95 wt% HMX/2.5 wt% Estane/2.5 wt% BDNPA or BDNPF, X-0242	20 years
PBX 9502	9502	95 wt% TATB/5 wt% Kel-F 800, X-0290	20 years
PBX 9503	9503	80 wt% TATB, superfine/15 wt% HMX/5 wt% Kel-F, X-0351	20 years
PBXN-5		See LX-10	20 years
PBXN-110		88 wt% HMX/5.4 wt% polybutadiene/5 wt% isodecyl pelargonate	20 years
PBXW-113		See PBX N110	
Primacord		Assorted PETN & RDX loaded commercial detonating fuse	20 years
Pentolite	5001	50 wt% PETN/50 wt% TNT	20 years
Tritonal		80 wt% TNT/20 wt% aluminum powder	20 years
X-0208	X-0208	See XTX-8004	20 years
X-0233	X-0233	5-40 wt% HMX; 40-95 wt% tungsten, 0-10 wt% polystyrene, 0-5 wt% plasticizer	90 days
X-0242		See PBX 9501	20 years
X-0282	X-0282	See LX-14	20 years
X-0290	X-0290	See PBX 9502	20 years
X-0309	X-0309	75% TNT, 19% aluminum powder, 5% D-2	90 days

		wax, 1% acetylene black (carbon)	
X-0351		See PBX 9503	20 years
X-0407	X-0407	69.8 wt% TATB, 25.0 wt% PETN, 0.2 wt% dye, 5 wt% kel F800	90 days
X-0533	X-0533	See Calcitol	90 days
X-0534	X-0534	50 wt% TNT/16–24 wt% $CaCO_3$/25–33 wt% talc/1–2 wt% microballoons	90 days
XTX-8003		80 wt% PETN/20 wt% Sylgard 182	20 years
XTX-8004		80 wt% RDX/20 wt% Sylgard 182, formerly X-0208	20 years

PROPELLANTS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev Period
Black powder		Standard commercial and military grades only	20 years if unopened, 2 years if opened
Benite	-	Black powder based mixture	2 years
Commer-cial sporting		Any commercially available smokeless gun propellant for sport use is approved	20 years if unopened, 2 years if opened
HARP-1,-2		HARP propellants are Al/AP/HMX composites	2 years
HELP-1, -2		HELP propellants are NC/NG/HMX composites	2 years
Smokeless Powder Single, Double, or Triple Base		Standard military grades. Military research explosives are specifically not included.	2 years
VTP 25540		HMX based High Energy Propellant	2 years

DETONATORS

The following high-energy detonators have been approved for use in test devices. All listed detonators have a storage review period of 20 years.

1E23	ER-213	EX-12	SE-1
1E26	ER-235	EX-12B	SE-1/31

1E26B	ER-312		
1E27	ER-312B	MC1991	SC-101
1E29	ER-344	MC2320	
1E30	ER-347	MC2427	
1E31	ER-352		
1E33	ER-353	MK13C	
1E34	ER-370	MK20	
1E36	ER-349	MK22A	
1E38	ER-350		
1E38 T.F.	ER-351	RL1	

DETONATORS, Continued

	ER-371	RL2	
	ER-377		
	ER-379	RP-1	
	ER-380	RP1/31	
	ER-383	RP-2	
	ER-396A	RP-80	
	ER-396B	RP-83	
	ER-400	RP-84	
	ER-402	RP-87	
	ER-403		

MUNITIONS

Military munitions are allowed if no further assembly or disassembly operations are involved. An adequate description should be in the DX-4 file. Internal devices that contain primary explosive are allowed if they are "out-of-line" and are not used as the initial initiation point. The initiator must remain in a safe state until the first ignition source is activated following standard operating procedures. Any configuration where the primary explosive unit is external or is to be used as the first initiation or ignition source becomes a special operation requiring a separate SOP or SWP.

Some of the DX-4 military munitions are listed as rejects or defective lots because they do not meet either physical specifications or performance testing specifications. There are no safety issues related to their rejection. Any arriving munitions marked as rejects will be treated as Storage Compatibility Group L until the reason for rejection is known.

SPECIAL EXPLOSIVES

The use of these explosives is limited to the provisions of the indicated SOPs.

Explosive	Pertinent SOP References	Storage Rev. Period
Liquid Gun Propellant LGP 1846	DX-11 SOP: 15-11-4.20, "LGP 1846, TA-36-3"	2 years
3E-1 Detonator	3E-1 SWP	20 years

COMPOUNDS FOUND in TA-16 SOP 1.1.0, "Established Explosives at TA-16," but not listed in any DX Division list.

Al-ANFO

BDNPA

BDNPF

BTX (5,7-dinitro-1-picrylbenzotriazole) (transportation only)

DNPA (2,2-dinitropropyl acrylate polymer)

DNT

HBX-1

Methane/ Oxygen mixtures

Nitrocellulose (NC)

PYX (2,6-Bis picrylkamino0-3,5-dinitropyridine)

STRATABLAST C (storage and transportation only)

TAGN (triamino guanadine nitrate)

TAL-1005E (storage and transportation only)

TNS (Trinitrostilbene)

TNT/NC

TPM (tripicryl melamine)

Attachment 2

Adhesives, glues, and coatings routinely used at DX Division Firing Areas.

- Methylmethacrylate/solvent glues (Duco, Testor's model cement, other proprietary materials of equivalent composition).
- 3M Industrial Adhesive-226.
- CTA-2 linoleum cement for Detasheet only.
- Elvanol.
- CPR-1009-78 adhesive.
- Silastic TRV-140, -731, -732, -892, -3145
- Eastman 910, Perma Bond 910 adhesive, Loctite 495 adhesive, and other cyanoacrylate ester adhesives .
- 3M Aerosol spray adhesive.
- Aralhex.
- GE Silicone Rubber RTV 162.
- Polad [10 wt% Polacure-740M diamine (Polaroid Corp.)/38 wt% Adiprene 5333/52 wt% acetone].
- Polyurethane 7200, with sets A and B.

When necessary, the following chemicals and gases may be used for light intensification or quenching.

Aluminum Fluorosilicate (**This is a poison; wash hands after use.**)
Aluminum Oxide
Butane
Krylon Spray Paint
Magnesium Oxide
PETN paint

Approved Glues and Adhesives

- An epoxy -polyamide adhesive know as "Green Glue" and formulated from Epon 828 and Versamid 140 is approved for use in detonator and HE assemblies. This adhesive is covered under Mound Facility's Specification 1-9600.
- Cyanoacrylate adhesives such as Eastman 910 may not be used in direct contract with PETN.
- Devcon 5-minute epoxy is approved for permitted explosives, except TNT and explosive compositions containing TNT, and is permitted for assemblies which will hold liquid explosives after the adhesive is cured.
- Barco Bond 165 and 185 - The curing reaction for this material is exothermic: therefore, the thickness of the adhesive layers must not exceed 1.5mm (1/16 in.).

- Sylgard 182, 184, and 186
- DC 93-119
- GE 630
- CPR-1009-78 + Component "T"

Adhesive	Additive or Catalyst	Remarks
Aerobond 2017	Trimethoxy-boroxine	Compatible with HE. Exothermic reaction. Don't make more than 50 g at a time.
VEEP 1579 VEEP 1579T	Versamid 140 DMP-30	Not compatible with all HE. May be used on PBX 9502, TATB, and mixtures of TATB and inert materials.
Torr Seal	Polyamide	Can be used on HE as described in report #250. Ideal for vacuum applications, sealing leaks.
Polamine 1000 cured polyurethanes		Compatible with HE. Slight foaming from moisture. Do not breathe vapors.

Attachment 3

DX Division Preparation Rooms

Location of charge preparation rooms at TA -15 and TA-36:

Building TA-15-242

Building TA-36-4, Room A (Eenie Site)

Building TA-36-5, Room A (Meenie Site)

Building TA-36-7, Room A (Minie Site)

Building TA-36-11, Room A (Lower Slobbovia)

Building TA-36-82 (Daisy Mae-Kup)

Assembly and preparation areas at TA-40:

Building TA-40-14 serves Firing Chamber 15

Building TA-40-11 room 106 administered by DX-1 as part of crystal growing operation at TA-40-12

Building TA-40-6 serves Firing Chamber 5

Building TA-40-41 serves Firing Chamber 4, and miscellaneous large shots

Building TA-40-3 is administered by DX-1, as a part of gas gun operations.

The assembly and preparation area at TA-14 Q Site is

Building TA-14-23 rm 104.

Shot preparation facilities at TA-39 are:

Building TA-39-4	trim shack
Building TA-39-111	shot assembly building

Building TA-39-77 propellant assembly for gas guns is administered by DX-1.

Attachment 4

List of the net names, call signs, frequencies, and normal use areas for radios.

DX Radio Channel	Organization Call letters
1	DX 1
2	DX-2
3	DX-3
4	DX-4
5	DX-5
6	DX-6
7	DX-7
8	DX-DO
9	DX Fleet
10	Emergency
11	Emergency
12	Emergency
13	Emergency
14	Emergency
15	Emergency

Attachment 5

Load Limits for DX Division Facilities

Explosive (Load) Limits During Firing Operations. The firing load limit is the maximum amount of explosive that may be fired at a firing site without special authorization. The maximum amount may be further modified by location of the shot relative to the portglass and the bunker. See site-specific SOPs.

Usual HE Firing Limits at Firing Sites

Building or Site	Limit (kg)	Limit (lbs)
TA-14-34	see site-specific SOP	see site-specific SOP
TA-15-306*	68	150
TA-15-310*	68	150
TA-36-3	227	500
TA-36-6	907	2000
TA-36-8	907	2000
TA-36-12	2268	5000
TA-39-6	91	200
TA-39-57	227	500
TA-39-88	908	2000
TA-40-4	25	55
TA-40-5	0.45	1
TA-40-8	10	22
TA-40-15	25	55

*Limits away from the runways at R310 and R306 firing areas can be exceeded only with the approval of the DX-4 Group Leader or designee.

These limits may be modified by permission of the Group Leader through the SWP process.

Storage Magazine Load Limits and Personnel Limits

Each Magazine has a maximum limit on the amount of explosive that can be present during Normal operations. The limits for DX Division magazines are listed below, and in the Firing-Point-Specific SOPs.

Explosives Load and Personnel Limits at
DX Division Magazines

	structure	load limit, kg	personnel limit	
TA-14				
	Q-22	300 lbs		C
	Q-24	25 lbs (detonators)		
TA-15				
	TA-15-41	200 lbs (propellant)	2	
	TA-15-42 wing vault	2000 lbs	4	
	TA-15-43 magazettes (2)	300 lbs 1000 dets.	3	
	TA-15-241	100 lbs	3	
	TA-15-243	2000 lbs	3	
TA-22				
	TA-22-18	500	3	D
TA-36				
	TA-36-83 Promoe	70,454	7	
	TA-36-83 Promoe side rooms (2)	1000 each part of 70,454 total	7	
	TA-36-10 Moe	4500	5	
	TA-36-9 DetMoe	50	2	
	TA-36-7, south end Minie Site magazine	200	5	
	TA-36-11, south end Lower Slobovia	200	5	
	TA-36-4, west end Eenie magazine	200	5	
	TA-36-205 Ammunition transportainer	450	3	
TA-39				
	TA-39-3	7,500 lb.	4	

	TA-39-5	3,000 lb.	3	
	Vaults/each	10 lb.	-	
	TA-39- 77	300 lb.	3	DX-1 jurisdiction
TA-40				
	TA-40-13 magazette	180 2.0	3 N/A	D
	TA-40-10 (DX-1)			
	TA-40-7 magazette	2.0 2.0	4 N/A	D
	TA-40-2 magazette	40 2.0	3 N/A	L A
	TA-40-40T		N/A	H_2O_2
	TA-40-40	36	4	D
	TA-40-38	165	3	D
	TA-40-37	360	3	
	TA-40-36	360	3	D
	TA-40-39 (DX-1)	57	3	D

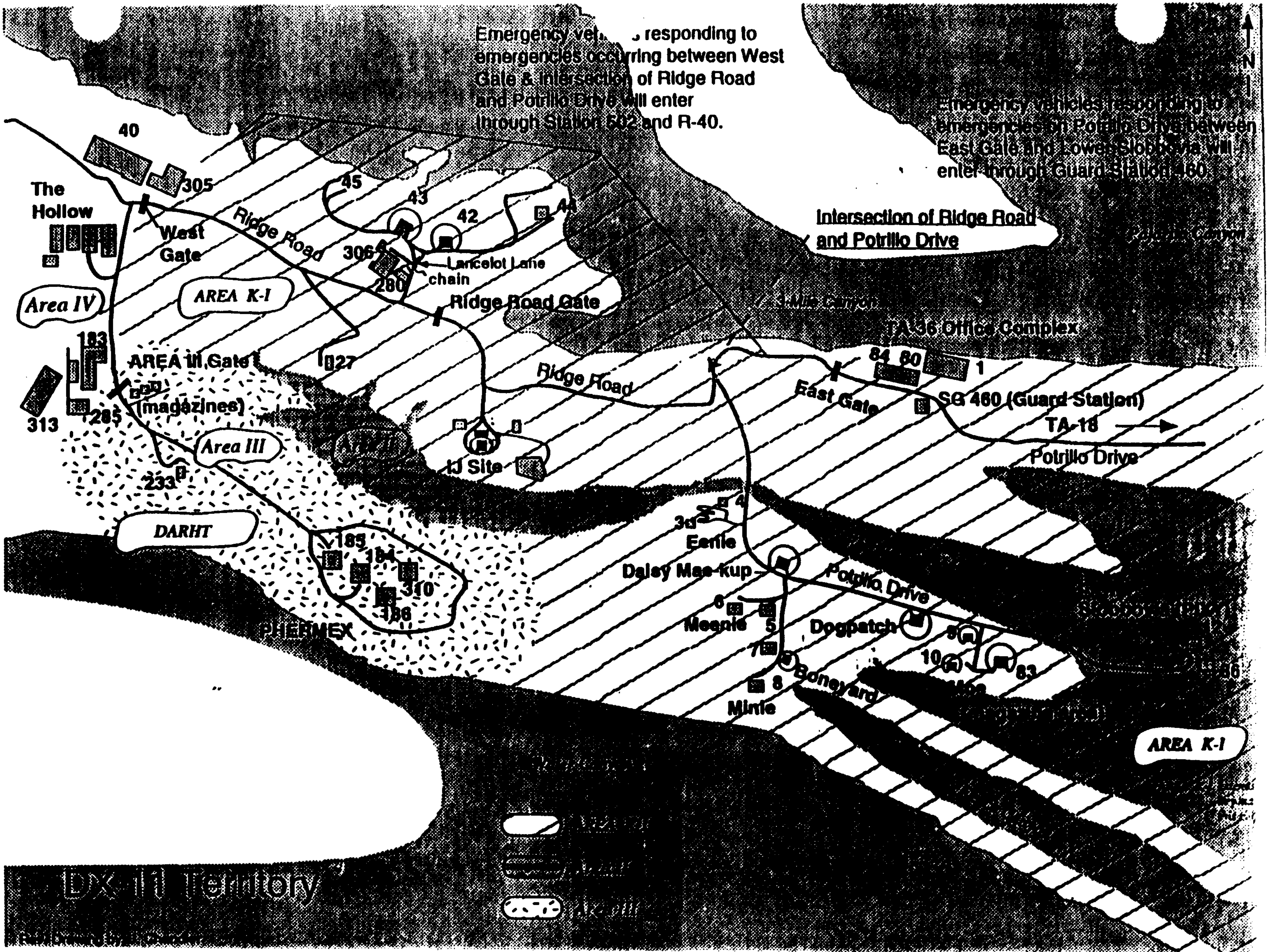
Preparation Room Personnel and Explosives Load Limits

Each Explosives Preparation Room has a maximum limit on the amount of explosive that can be present during normal operations. The limits for DX Division Preparation Rooms are listed on the door of the Preparation Room.

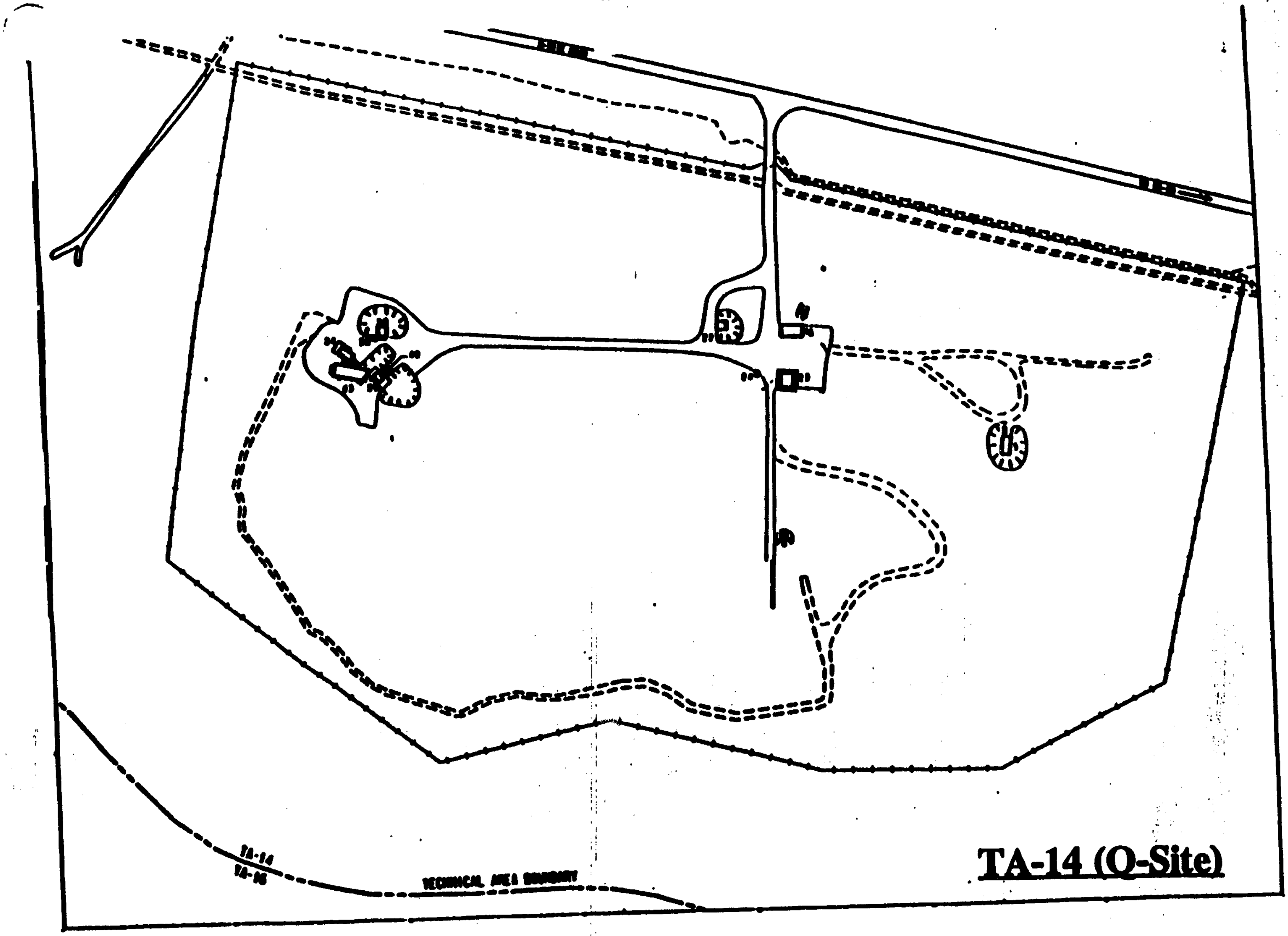
Personnel limits are established to prevent crowding of the preparation room from causing an accident, and to limit casualties in case of an accident.

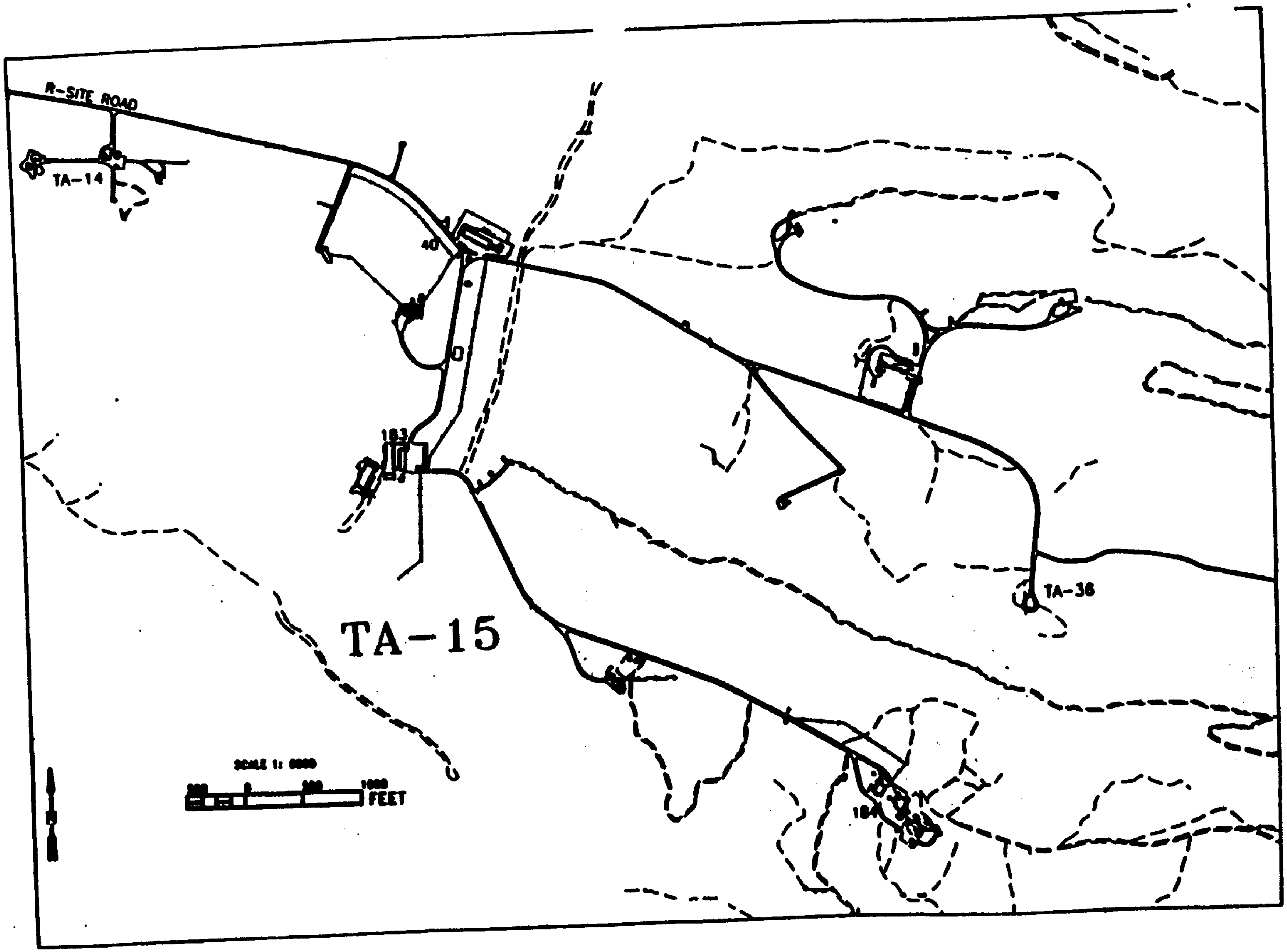
Personnel and Explosive Load Limits at DX Division Preparation Rooms

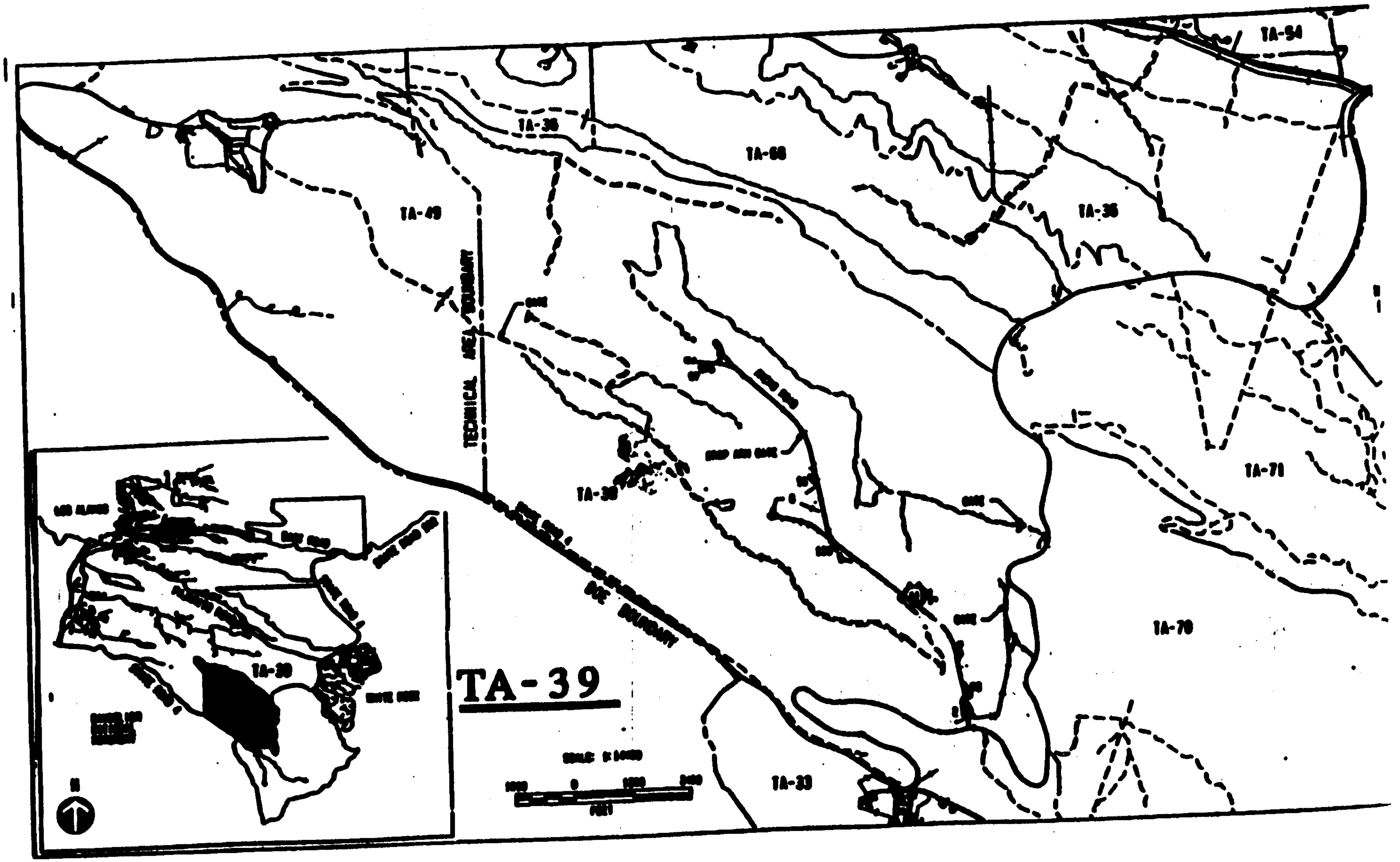
	Building No.	Operators	Casuals	Explosives (kg)
TA-14				
	TA-14-23 room 104	2	1	50
	TA-14-23 room 104	6	0	0
TA-15				
	TA-15- 242			
TA-36				
	TA-36-4	2	2	100
	TA-36- 5	2	2	100
	TA-36- 7	2	2	100
	TA-36-11	3	2	100
	TA-36-82, each room	3	2	No explosive storage, except shot assemblies in process or waiting to be fired.
	TA-39-4 Trim Shack			
	TA-39-111 Assembly Building			
TA-40				
	TA-40-3	3	0	2
	TA-40-6	5	0	2
	TA-40-11 (room 106)	5	0	2
	TA-40-14	4	0	25
	TA-40-41	5	0	36



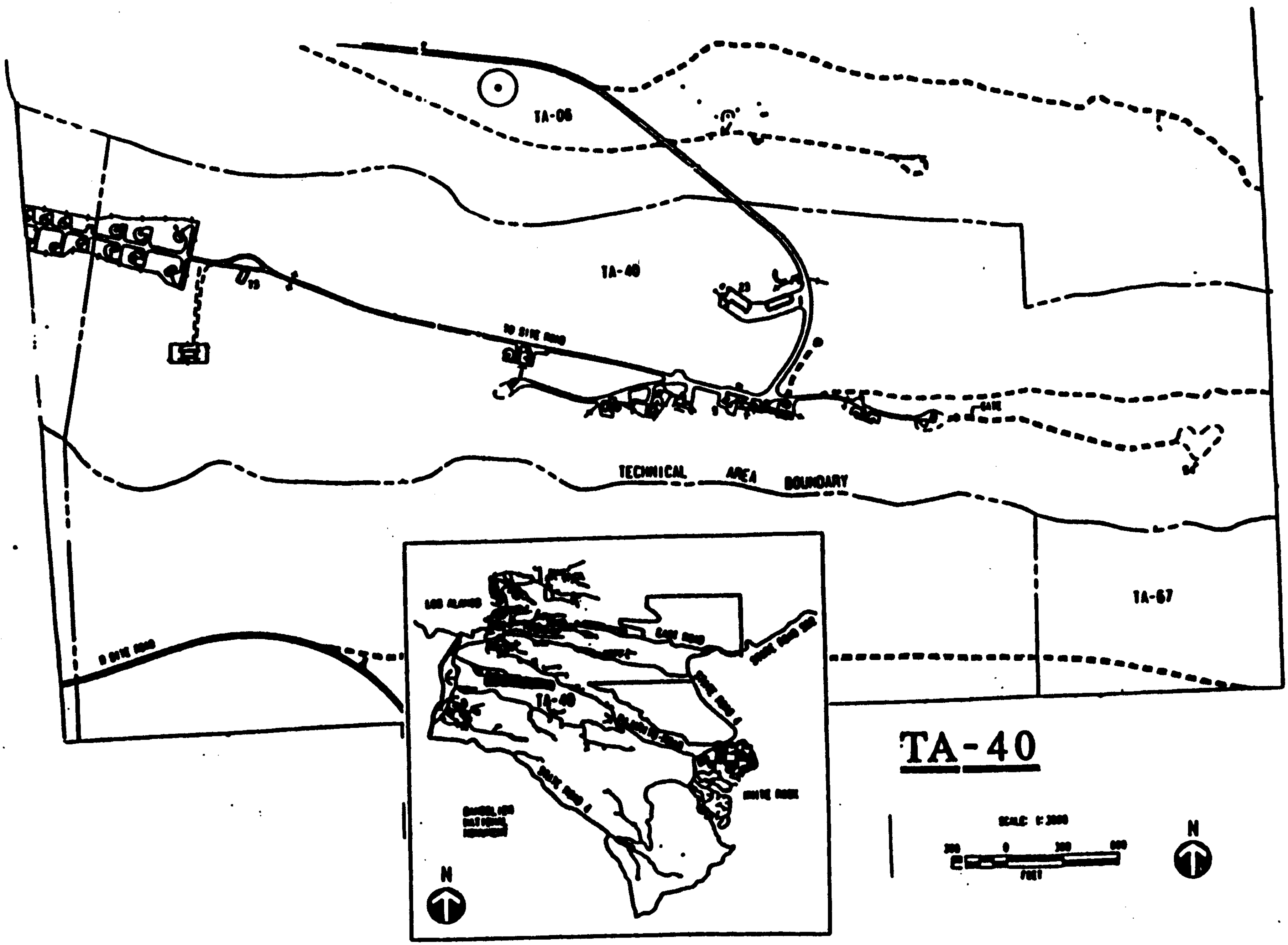
emergencies occurring between West
Gate & intersection of Ridge Road
and Potrillo Drive will enter
through Station 502 and R-40.
Intersection of Ridge Road
and Potrillo Drive
N
40
305
The Hollow
West Gate
Ridge Road
45
43
42
44
306
280
Lancelot Lane
chain
Ridge Road Gate
Area IV
AREA K-I
183
AREA III Gate
27
313
285
(magazines)
Area III
233
IJ Site
Ridge Road
TA-36 Office Complex
84
80
1
East Gate
SG 460 (Guard Station)
TA-18
Potrillo Drive
DARHT
185
184
310
186
PHERMEX
4
3
Eenie
Daisy Mae-kup
Potrillo Drive
6
Meenie
5
Dogpatch
9
10
83
7
8
Boneyard
Minie
AREA K-1
DX-11 Territory


TA-14 (Q-Site)
TECHNICAL AREA BOUNDARY
TA-14
TA-16


R-SITE ROAD
TA-14
40
183
TA-15
TA-36
184
FEET



TA-39
TA-49
TA-36
TA-68
TA-33
TA-70
TA-71
TA-54
TECHNICAL AREA BOUNDARY
DOE BOUNDARY
TA-30
FEET
N


TA-06
TA-40
TA-67
TECHNICAL AREA BOUNDARY
D SITE ROAD
N
SCALE 1:3000
FEET

TA-40

Attachment 6

TNT Equivalent of some Common Explosives

Traditionally, load limits are expressed in terms of "Pounds (or kg) of TNT Equivalent." Because the explosive power of some explosives exceeds that of TNT, the actual weight of these explosives needed to reach the load limits are less the number of Pounds of TNT Equivalent.

TNT Equivalent Weights

Explosive	Equivalent
BARATOL	0.525
COMP B	1.092
C-4	1.129
HMX	1.042
LX-01	1.222
LX-10	1.101
LX-11	0.874
LX-14	1.119
NG	1.136
NQ	0.752
OCTOL 70/30	1.113
PBX-9007	1.108
PBX-9010	1.044
PBX-9011	1.087
PBX-9502	1.037
PBX-9404	1.108
PBX-9407	1.136
PBX-9501	1.129
PENTOLITE	1.085
PETN	1.169
RDX	1.149
TATB	1.037
TETRYL	1.071

Attachment 7

Definition of explosive contamination.

Memo from the ERC attached.

Ron Rabie, 02:41 PM 3/6/96 -, Contamination

Date: Wed, 6 Mar 1996 14:41:16 -0700
X-Sender: u0846970pobox1663.lanl.gov
To: vasilik_gerald_d@Lanl.GOV
From: rabie@Lanl.GOV (Ron Rabie)
Subject: Contamination

Jerry;

Here is a draft of a memo on the subject of firing site contamination.

With reference to the memorandum to Distribution dated November 29, 1993 from Lucht at DX-16, and the statment therein, "Items which only have trace (non-visible) amounts of non toxic HE on them and are not hazardous in any way, should not be labeled contaminated", the Explosive Review Committee (ERC) wishes to add the following. "The word Items is not restrictive in any sense and may be assumed to apply to shot stands, insulation, shot assembly aids, firing cables, optical components including mirrors, sand bags, barriers, electrical equipments, metal assemblies, etc. The presence of soot on various materials used, abused or consumed in the course of firing a shot does not, of itself, constitute HE contamination."

This elaboration of the original text is meant to clarify the meaning of the original and not to alter the spirit of the original.

Ron Rabie, Acting ERC Chairman

LOS ALAMOS
NATIONAL LABORATORY
memorandum
EXPLOSIVES TECHNOLOGY
EXPLOSIVES REVIEW COMMITTEE

To/MS: Distribution
From/MS: Roy Lucht/C920 Roy
Phone/FAX: 5-0111/7-0500
Symbol: DX-16
Date: November 29, 1993

SUBJECT: Contamination

I recently received a request (enclosed) from Tom Turner (DX-10) for an "official" definition of explosive contamination. Our current charter directs us to review and advise on regulations and administrative directives involving explosives operations at the Lab. Thus, the best I think we can do for Tom is to offer a proposed definition or set of procedures for handling contamination.

It is clear that following the DOE Explosive Safety Manual guidance on decontamination to the letter would put Lab explosives work out of business. For example, with strict interpretation Lab vehicles driven in firing sites and other explosive contaminated areas should be decontaminated before being driven on public roads or repaired by GSA. If GSA needed to weld a new muffler on a site truck, it should be decontaminated to level XXXXX, which would involve complete disassembly. The same is true of any such truck released for public auction.

Thus, we need to follow the intent of the guidelines, ensure that no one, Lab or public, is injured as a result of explosives, and ensure that our guidelines fit within at least a liberal interpretation of the DOE Explosive Safety Manual. It is also true that some tests are so sensitive that an item could be hazard free but still give a positive test result. Because an item has been used in an explosives area, does not mean it is contaminated, just potentially contaminated. According to the DOE Explosives Manual, a "0" classed item is an item from an explosives area that was never directly exposed to contamination. Many site trucks and some of Turner's instruments may fall into this category. If we can in good conscience declare 0 class for an item, a visual inspection is probably adequate for release for repair, calibration, or even salvage. Thus for site trucks or lab instruments such as scales which may be used to hold contained or packaged HE, but do not come into direct contact with it, a visual inspection may be adequate to declare the item to be class 0. For trucks driven over potentially contaminated ground, visual inspection of the tires and wheel wells may be required.

Items which have definitely come into contact with bare HE are more difficult and may have to be handled on a case-to-case basis. Unless the material is also toxic, trace (non-visible) amounts detectable by sensitive tests are not hazardous. Thus, I would propose the following definition: "Items which only have trace (non visible) amounts of non toxic HE on them and are not hazardous in any way, should not be labeled contaminated." This, I believe, agrees with the intent of the XXXXX designation in section 18.6c.3. in the DOE Explosive Safety Manual. However, if an item may have hazardous amounts of HE hidden in them in cracks, joints, voids, etc., then the item would fall into class XXX, and could not be released for welding etc. as in section 18.6c.2.

Regardless of what guidelines are used, a fair amount of subjective evaluation is left to the person involved with the decontamination. Guidelines cannot be written to cover every contingency, so care must be taken that an item with hazardous amounts of HE is not released for repair, salvage etc.

Committee: If you have any thoughts, comments, changes, additions, etc. on this, please return them to me by COB 12/17/93.

DX-4

STANDARD OPERATING PROCEDURE

FOR

GENERAL FIRING OPERATIONS

SOP 4

Prepared by: Roger K. London, DX-4 Date: 12-9-96

Approved by: G. Vasilik, DX-4 ES&H Officer Date: 12-11-96

Approved by: John M. McAfee, DX-4 Group Leader Date: 12-17-96

Approved by: ESH Deployed Team Leader Date: 12-23-96

Approved by: DX-DO Date: 12/20/96

Controlled Document Number:

Table of Contents

1.0 INTRODUCTION

This SOP covers the conduct of explosives test-firing operations and nonexplosive tests conducted at DX Division firing sites. This document is not to be used as a "stand alone" document. Further training and understanding a site-specific SOP are required before conducting firing operations at any DX Division firing area or site.

2.0 PURPOSE

This SOP provides necessary information, describes the hazards, and specifies safety procedures common to all Firing Areas. Detailed descriptions of operations at particular firing sites may be found in the Site-specific SOPs for those firing sites. This SOP also generally describes the procedures for preliminary preparations, circuit testing, clearance, firing operations, misfires, test failures, and postshot activities at DX Division firing sites.

3.0 SCOPE

This SOP is applicable to all personnel who frequent the areas listed below, or who are authorized to perform explosives firing operations at the areas operated by DX-4. In addition, DX-4 support personnel (staff members, appropriate clerical personnel, etc.) shall also be familiar with this SOP.

This SOP covers operations at the following firing sites.

Building or Site	Common Reference
TA-14-34	Q Site
TA-15-306	R306
TA-15-310	R310, PHERMEX/MOC
TA-36-3	Eenie Site
TA-36-6	Meenie Site
TA-36-8	Minie Site
TA-36-12	Lower Slobbovia
TA-39-6	Point 6
TA-39-57	Point 57
TA-39-88	Point 88
TA-40-4	Chamber 4
TA-40-5	Chamber 5
TA-40-8	Chamber 8 (10-kg vessel)
TA-40-15	Chamber 15

These Explosives Firing Sites are identified on the Maps in Attachment 1.

Gun facilities at TA-39 and at TA-40 are under the jurisdiction of DX-1.

Access to the firing areas is covered in the DX-4 SOP, "General Access Control," and by area-specific SOPs for TA-14, TA-39, TA-40, Area III, and Area K-I.

4.0 DEFINITIONS

- **Aborted Shot** -- An aborted shot is one that for any reason cannot be fired as planned and is to be returned to storage.
- **Access Gates** -- Gates or chains that can be locked. The keys are administratively controlled by the Access Control Office and the Local Access Offices.
- **Barricade** -- A portable device, such as a sawhorse, with an appropriate sign, used to halt traffic into an area that is hazardous or is about to become hazardous.
- **Bunker** -- The main protective building at a firing site, housing the control room, and usually the CDU, camera and diagnostics.
- **CDU** -- Capacitor Discharge Unit.
- **Chamber** -- Bunker. The main protective building at a firing site, housing the control room, and usually the CDU, camera and diagnostics.
- **Clearance** -- Process by which an exclusion area is established and determined to be free of unprotected personnel, and safe for a firing operation.
- **Clearance Checklist** -- A step by step guide to ensure that each element of the clearance plan is executed and documented.
- **Clearance Patrolman** -- A Knowledgeable Person who physically inspects a clearance area or manually observes a barricade to assure that people are excluded from hazard zones.
- **Clearance Plans** -- Procedures that protect personnel within the firing areas by controlling conditions during explosive experiments, radiographic operations, or other potentially hazardous operations. The level of the clearance plan determines the control procedures to be followed.
- **Cleared Area** -- An area that has been physically patrolled by a Clearance Patrolman performing assigned duties, or an area in which all personnel have been accounted for. A Cleared Area has been declared safe for firing operations to proceed.
- **Detonator Cable** -- The electrical conductor connecting a detonator to a CDU, or any initiating device to a firing unit.
- **EED** -- Electroexplosive Device
- **EBW** -- Exploding Bridgewire
- **Firing Area** -- The areas where firing operations are conducted. Access to these areas is controlled, and is through an Access Gate. These areas are K-I, Area III, TA-40 Firing Area, TA-39 Firing Area, and TA-14.
- **Firing Cable** -- The electrical conductor conveying a trigger or firing pulse to a CDU or other firing unit.

- **Firing Checklist** -- (may include clearance checklist) A list of steps to be taken in preparing to fire and firing. Used as a reminder to ensure that no steps are forgotten, and all steps are documented.
- **Firing Keys** -- Strictly controlled keys that unlock firing circuits.
- **Firing Leader** -- A DX Division employee, authorized by DX-4 line management to supervise, conduct, and be responsible for operations at the site of the test. This person's accumulated knowledge and experience are crucial to all explosives firing operations.
- **Firing Point or Site** - The actual location of an explosive test and its exclusion area behind the appropriate safety gate.
- **Firing mound** -- Firing mound refers to the sand pile or steel firing pad on which the shot assembly is placed.
- **Hazard Circle** -- A region, not always circular in shape, that is evacuated in a clearance plan because shrapnel from the shot is expected to land within that region. May also be called a hazard zone or a fragment area. However, the definition of a Hazard Circle is only a guideline, fragments occasionally land outside of them.
- **Hazard Zone** -- Hazard Circle
- **HE** -- High Explosives.
- **HV** -- High Voltage
- **HVPS** -- High Voltage Power Supply
- **Low Energy EEDs** -- Hot-wire initiators, squibs, blasting caps, etc.
- **Misfire** -- That which occurs when there is no evidence of detonation or energy release after pulsing the firing circuit.
- **Partial Firing** -- When one or more of the explosive charges in an experiment fail to initiate. Often significant quantities of unreacted explosives are scattered on and around the firing mound.
- **PFN** -- Pulse Forming Network. (includes pin boards and pulse boosters)
- **Roadblock** -- A roadblock is established by having a DX Division employee or trained Knowledgeable Person (Clearance Patrolman) in the road to stop traffic. The roadblock may be an employee with a radio, or an employee with a radio and a vehicle. This person maintains contact with the Firing Leader and the Access Control Office as necessary.
- **Safety Gate** -- A gate at the entrance to a Firing Site. The last gate before hazard is encountered. A safety gate may be interlocked.
- **Shot Information Packet** -- For the Fire Department, a list of hazardous materials included in shots that they attend, and MSDS forms for those materials.
- **Test Mode (Firing circuit)** -- A condition in which firing circuits may have power on them, while clearance conditions are not met, by use of a special key and a special procedure. Administrative requirements for using test mode are defined in site-specific SOPs. Neither detonators nor explosives are connected to the firing circuit in test mode.

5.0 RESPONSIBILITIES

5.1 Personnel Responsibilities

5.1.2 Firing Leader

Shall have immediate responsibility for the operational safety of an operation, and shall be the final authority on questions of safety and procedure during operations at a Firing Point.

- Knowledgeable about group SOPs and operations.
- Responsible for selecting or confirming the choice of the appropriate clearance plan (hazard circle) for the shot, based on experience, knowledge of shot design, calculations, DOE or DoD guidelines, and weather conditions.
- Responsible for overseeing the safety of the firing crew, other personnel, equipment, and facilities at the firing site. Responsible for the safety and security of the firing operations.
- Responsible for personnel control on the firing mound or in the firing chamber.
- Shall not permit firing until all personnel within the hazard zone of the shot are in safe shelters, or are removed from the hazard zone.
- Responsible for firing keys during firing operations.
- Ensures that safety and operational equipment is used properly.
- Participates in inspections; ensures that any defects found during routine maintenance and inspection are corrected by the appropriate personnel.
- Assists in critiques and accident investigations; reports occurrences.
- May delegate some responsibilities to authorized personnel.

5.1.3 Access Control Officer

- Participates in clearance procedures as appropriate. Interacts with Firing Leader for firing operations.
- Interacts with Lead Clearance Patrolman during a clearance.
- Administers personnel access into firing areas.
- Responsible for managing the exchange badge process, both pictured exchange badges when used for Knowledgeable employees, and visitor badges.
- Responsible for the flow of personnel to and from firing areas.
- Verifies that requirements for visitor access are met. Maintains visitor access documents and records.
- Is the single point of contact between the firing sites and the Fire Department.
- Frequently handles communication to DX-4 Group Office, DX Division Office, and security personnel, on behalf of the Firing Leader.

5.1.4 Clearance Patrolman

- Assists activities in the firing area, including communications, traffic, and visitor control, when a clearing or firing operation is in progress.
- Responsible for the successful performance of clearance processes and post-shot sweeps.
- Erects and controls barricades as necessary along access routes. Locks safety gates with key controlled by the Firing Leader or Lead Clearance Patrolman as necessary; posts warning signs for approaching traffic and removes barricades when clearance is lifted.

5.2 Required Reading

5.2.1 Each employee who participates in firing operations must read this SOP, other applicable general SOPs, and the Site-specific SOP(s) applying to the firing site(s) used.

5.2.2 The DX-4 Group Leader or designated line supervisors will determine who must read these SOPs, and who will be authorized to work in the DX Division firing areas.

5.3 Training

5.3.1 All training is to be in accordance with the DX Division Training and Qualifications Manual. Explosive operations shall be performed only by personnel with proper training and supervisory approval.

5.3.2 Supervisors are responsible for on-the-job training, documentation of on-the-job training (as required), detailed instruction, and for monitoring the operators for competence and adherence to instructions.

5.3.3 All personnel conducting or involved in on-site preparation or firing activities shall have read, understood, and agreed to adhere to the established procedure and requirements of this SOP, the DX Division Operations Manual, the LANL Electrical Safety Program, the DX Division ES&H Charter, and the local Building and Site Emergency Plans.

5.3.4 All visitors present during a firing operation shall have read, understood, and agreed to adhere to the Visitor Instruction Packet and to the instructions given by the Firing Leader or his designee.

5.3.5 Fire Department Training

The Fire Department shall be provided with the Visitor Information Packet, Off-Road training, and the Shot Information packet (MSDSs of hazardous materials) for each shot they attend.

5.4 Waste Minimization

5.4.1 Waste minimization will be handled according to the Waste Minimization section of the DX Division Operations Manual and the LANL ES&H Manual, AR 10-8.

5.4.2 Waste generated from firing operations must be reduced as much as technically and economically feasible. Material substitution, good housekeeping, and hazard segregation must be incorporated into all waste generating activities, in order to meet this objective.

5.4.3 All waste will be handled according to the DX Division SOPs 1, and 6, governing waste and the LANL ES&H Manual, AR 10-3.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Administrative

6.1.1 Appropriate Standard Operating Procedures (SOPs) or Special Work Permits (SWPs) shall be available before any explosives operation is performed. Such SOPs or SWPs shall be available at the site of the operation and shall be understood and obeyed. When operations will be performed that will change or bypass these procedures or introduce additional hazards, a Special Work Permit (SWP) or another SOP will be written and approved to cover each operation.

6.1.2 Any major departure from previously approved shot configurations must be reviewed by the DX-4 Group Leader or designee before firing. A change in configuration includes any change in hazard resulting from alterations in firing protocol, materials, shrapnel potential or direction, heating methods, invasive diagnostics, electrical equipment, location on firing mound, or any other modifications.

6.2 Identified Hazards

Explosives, high voltage, x radiation, laser radiation, chemicals, DU, and normal industrial hazards are the hazards identified with firing operations. These and other hazards associated with firing and other DX-4 operations are described here, in the General Safety SOP, and other operation- or site-specific SOPs. Some of the general hazards to be aware of are:

- Explosives testing is loud. Hearing protection must be provided at all operations where there is a potential for hearing damage.
- Electrical hazards exist due to the firing circuits and High Voltage circuits or those used to power the circuits that are used to gather data.
- Lightning is a hazard, particularly where explosives are present. All operations involving explosives are suspended during electrical storms in accordance with the DOE Explosives Safety Manual. Any person perceiving a safety hazard from lightning may suspend the operation.
- Cranes, crane operations, and forklift use are discussed in the DX-4 Hoisting and Rigging SOP.
- Vacuum and high pressure lines or vessels, or use of HE under vacuum, present serious mechanical and explosive hazards which are discussed in the DX-4 Vacuum SOP.
- Radiography is covered by site-specific Firing SOPs, the DX-4 Portable X-ray Operation SOP, and the DX Division Radiation Protection SOP.

6.3 General Considerations

6.3.1 Access to Firing Areas and Firing Sites

Access to all DX-Division Firing Areas is administratively controlled by the issuance of keys and through access control procedures detailed in the General Access SOP and Firing-Area-specific SOPs. Firing Areas are entered through key-operated gates. During hazard operations, firing sites are entered only with permission of Firing Leader.

DX-4 knowledgeable personnel and other knowledgeable personnel gain access to the firing areas by using administratively-controlled keys. All other individuals must clear through either the Access Control Office (for TA-15, TA-36, and TA-39), the DX-1 Group Office (for TA-40), the DX-2 Group Office (for TA-14), or the Administrative Office at TA-39 before they will be allowed access to a firing area. Qualified Office personnel instruct visitors on the site hazards, have them read the appropriate visitor information, and enter their names in a log. Access Control Procedures are discussed in detail in DX-4 Access Control SOPs, including "General Access Control."

6.3.2 Explosive (Load) Limits During Firing Operations

The firing load limit is the maximum amount of explosive that may be fired at a firing site without special authorization. The maximum amount may be reduced by location of the shot relative to the portglass and the bunker. See site-specific SOPs.

Typical HE Firing Limits at Firing Sites

Building or Site	Limit (kg)	Limit (lbs)
TA-14-34	see site-specific SOP	see site-specific SOP
TA-15-306*	68	150
TA-15-310*	68	150
TA-36-3	227	500
TA-36-6	907	2000
TA-36-8	907	2000
TA-36-12	2268	5000
TA-39-6	91	200
TA-39-57	227	500
TA-39-88	908	2000
TA-40-4	25	55
TA-40-5	0.45	1
TA-40-8	10	22
TA-40-15	25	55

*Limits away from the runways at R310 and R306 firing areas can be exceeded only with the approval of the DX-4 Group Leader or designee.

These limits may be modified by permission of the DX-4 Group Leader through the SWP process.

6.3.3 Personnel Limits During Firing Operations

The number of personnel present on the firing mound during shot preparation must be minimized, to minimize the number of people injured or killed in an accident and to reduce/disturbance of firing crew.

The maximum number of personnel allowed at the firing site when explosives are present is given in the site specific SOP for each firing site. For stated times and purposes, changes in the personnel limits may be authorized by the DX-4 Group Leader or designee.

6.4 Pre-shot

There are a number of limitations that are determined prior to the firing of a shot. These include identification of the hazard zone, clearance plan, and requirements for Fire Department support.

6.4.1 Hazard Circles

Hazard circles (zones) are pre-defined, and the appropriate size area (not necessarily circular) is chosen for each shot, according to the hazards associated with the size, materials, configuration, and explosives in the shot. The choice of hazard circle dictates the particular Clearance Plan which will be used. The area inside the Hazard circle is cleared before the shot, according to the Clearance Plan for the particular Firing Site. Specifics of clearance plans, and maps of most hazard circles, can be found in site-specific SOPs for the Firing Sites.

6.4.2 Clearance Plans

Clearance Plans have been developed to protect personnel within the hazard zones. Clearance Plans are specified for explosives firing operations, for the production of radiation or pulsed-power discharges, or for shots that may release toxic material.

Specific details of clearance plans are given in Site-specific SOPs for Firing Operations. Each Clearance Plan is based on a defined hazard circle within which all personnel must either be excluded or inside a bunker. Before the shot, a clearance procedure is used to locate personnel within the hazard area, remove them, and then physically block entrance to the area until the shot is done and the area is safe again.

- At TA-15 and 36, Clearance Plans are called A-Minor, A, B, and C, increasing in radius by increments of 250 meters.
- At TA-39, Plans are called levels 1, 2, 3, 4, and 5, and a separate safety gate exists for each level, at greater and greater distances from the Firing Site.
- At TA-40-4, two hazard circles exist.
- At TA-40-5, -8, and -15 and TA-14, a single hazard circle and Clearance Plan is used for every shot at a given Firing Site, based on the largest shot that will normally be fired at that site.

Provision for large shots can be made for any area at any time, using the SWP process.

6.4.3 Clearance Notices

When a shot is planned, a notice will be posted in one of four places, depending on the firing area:

- Area K-I, Area III - in the Access Control Office at TA-15-183
- TA-40 firing area - at both TA-22-90 and TA-40-1
- TA-39 - on the shot board in TA-39-2
- TA-14 - in R183 and the DX-2 Group Office at TA-9-21.

The Access Control Office at R183 will be informed of every shot, or series of shots, regardless of location. The notice will include the firing point, the date and time scheduled for firing, the level of the Clearance Plan, the Firing Leader, shot number, and other pertinent details as appropriate. This notice will remain in place until a safe condition exists.

6.4.4 Clearance Checklists

A Clearance Checklist is used by the Firing Leader and the Access Control Office for each Clearance Plan. Checklists may indicate the area to be cleared, the hazard radius, traffic control requirements, firing data, clearance announcement requirements, the names of the Lead Clearance Patrolman (if applicable) and Firing Leader, and other information about the shot. Clearance checklists are included in Firing Site SOPs. They may be part of the firing checklist.

6.4.5 Fire Department Notices

Fire department access to firing areas is controlled to avoid exposing the firemen to explosive or other hazards, but access must be rapid in case of a fire.

6.4.5.1 The Access Control Office at TA-15-183 will be notified if Fire Department activity is needed at any firing area. Access Control Personnel communicate with and advise the Fire Department when they are needed, and arrange for access to be available, rapid, and safe.

6.4.5.2 When the Fire Department is called to stand by, the hazardous materials in each experiment must be identified, and a packet of MSDS forms prepared, in case of a fire involving the experimental assembly. If the Fire Department is called to fight an unexpected fire that is caused by a shot, it is the Firing Leader's responsibility to inform the Fire Department of the presence and identity of hazardous materials.

6.4.5.3 Fire Department access is discussed in the site specific SOP for each Firing Site.

6.4.5.4 If more than one shot is fired with the Fire Department on standby, the Firing Leaders, Access Control, and the Fire Department will be in agreement that the first shot is complete and the area is safe, before the second shot can proceed.

6.5 Operations with High Explosives

Explosives operations usually begin with the receipt and storage of explosives and explosives-containing devices. Preparations of tests (assembly, gluing, etc.) can then be performed. These operations are described in the SOPs on Packaging and Transportation, Explosive Storage, and Preparation Room Operations.

6.5.1 Handling and Transfer of Explosives

The general precautions for handling HE are given in the General Safety SOP. Particular caution should be exercised in the movement of HE. Explosives will not be transported over walkways which are hazardous because of ice, snow, weed overgrowth, or other adverse conditions. Explosive handling shall be permitted only where handling areas are free of obstructions.

- Shots should be carried to the Firing Point with attention to footing and to tripping hazards such as sand, weeds, and cables.
- Shots must be placed by DX-Division knowledgeable personnel under the direction of the Firing Leader.
- Only qualified crane operators may operate cranes used to place shots. All lifts involving explosives are to be considered high-consequence lifts.

6.5.2 Tools and Materials

Various tools and materials may be used in the assembly of a shot and the associated diagnostics. Equipment and materials not specifically allowed by this and other DX-4 SOPs (with attachments) and SWPs is forbidden. In experiments involving other groups, equipment needed to prepare their part of the experiment is permitted on the firing point only if it is covered by a DX-4 SOP or SWP, or an approved SOP from that group; and if its use is not prohibited by the Firing Leader.

Mechanical

- Ordinary hand tools may be used near the charge, but may not be used to strike, cut, or otherwise work on the charge. The only forming and cutting operations on solid explosives which may be performed as a part of the assembly procedure are the hand forming of Composition C, and the cutting of Primacord and DuPont Detasheet with a razor blade. Bending of DuPont Detasheet explosive is allowed, as long as the radius of the curvature is greater than four times the sheet explosive thickness, to prevent tears.
- A staple gun may be used to secure wires or other non-explosive items to the charge stand or container.
- Equipment listed in Attachment 4 may be used on the firing point during the setting of the shot.
- When any of this equipment is used, appropriate shielding shall be used to prevent sparks, heat, or impact from reaching the explosive.

Electrical

- Any 110 volt alternating current that is used when personnel are present on the firing mound shall be Ground Fault Circuit Interrupt (GFCI) protected, unless GFCI renders the equipment inoperable (e.g. inductive motors). Equipment using a 110 volt alternating current must be kept a minimum of one meter from exposed explosives, or else an SWP will be used. Appropriate measures shall be taken to prevent such equipment from any contact with explosive(s). An insulating barrier such as Plexiglas between the 110V and the explosive allows closer proximity. After the mound area is clear of personnel, a normal 110 volt alternating current circuit may be used.
- No powered hand tool or appliance (except for a soldering gun) shall be used within 60 cm (2 ft) of bare explosive without an SWP. Bare explosive is explosive that is not protected by a barrier that can withstand fragments, sparks, heat, or tool bits (and broken tool bits) from damaging the explosive.
- Soldering may be done with a battery powered soldering gun or a soldering gun that does not remain hot when not in use. The hot tip is <u>always</u> kept at least 30 cm (1 ft) from any bare exposed explosive(s), and is kept one meter (3 ft) or more from any exposed explosive(s) when not in use.

6.5.3 Electronic Devices and Diagnostics

Many shots have electrically charged pins or switches incorporated into the assembly for diagnostic purposes. A variety of pin and gauge diagnostics are used in contact with bare explosive and propellant assemblies. It may be necessary to test experimental equipment and pin circuits with pulse-forming-network (PFN) pin voltage or other electrical sources turned on. General precautions for energizing these devices are given here. Details are specific to individual diagnostics and firing sites.

- Pin circuits may be assembled and attached to the transit-time electrodes with crimp connectors or alligator clips. Pin circuits and potential shorts in explosive monitoring pin and foil circuits may be checked using an approved ohmmeter powered with a 1.5-V battery such as a Simpson 160 or 260. The meter must be certified as specified in DOE *Explosives Safety Manual rev 7*, Chapter II, Section 13.8, and be approved by DX-1.
- Pins that are in direct contact with the explosive (co-ax, foil, painted switches, etc.) are often wired to separate plugs (known as H.E. plugs) so they can be identified and isolated from the PFN voltage supply. These plugs must be specifically labeled and verified by DX staff. These special plugs must never be connected to the PFN when the power is on. Before the firing party retires to the control room for a firing operation, the explosive pin and foil monitors are connected to the PFN with the power off.

- If the voltage and current are limited to less than 5 V and to 200 mA, then the power can be applied to the diagnostics without clearing the firing site.
- If the diagnostic power supply applies voltage greater than 5 V, or current >200 mA, then the supply is controlled by the firing control panel so that voltage cannot be applied to the gauge unless the firing panel/voltage key is used in the test or Fire Mode. If a test mode is available and is used, then the clearance for the shot must be in place, before applying current or voltage to the diagnostic on the bare explosive. After all personnel are in the control room or bunker, the PFN voltage can be turned on. If it is necessary to return to the firing point, the voltage to the HE plugs will be turned off and remain off until everyone has returned to shelter.

6.5.4 Vacuum

Some shot designs call for the use of a vacuum chamber. Any shot that requires a vacuum will comply with the procedures in the DX-4 SOP governing Vacuum Use in Field Tests.

6.5.5 Fissile Material

All weapons-mockup shot assemblies are monitored for fissile material according to pit-verification procedures described in the SOP, "Storage, Handling, and Verification of Uranium." The Firing Leader is responsible for overseeing monitoring. Another member of the firing crew verifies the monitoring.

6.5.6 Gas Handling

If the experiment involves filling a pressure vessel with gas or using methane in a confined assembly, special gas-handling procedures must be followed. These are described in the SOP, "Filling Pits with Gases at Firing Points." All other gas handling operations (e.g. Ar, Xe flashers, X-rays, and low pressure hydrogen fills) will be done in accordance with AR 14-1.

6.5.7 Assembling Experiments on the Firing Mound

Shots may be assembled at the firing mound. Shots delivered as separate components are assembled by the firing crew and placed on the shot stand. The firing crew shall take special care to ensure that all piece numbers have been recorded during assembly to allow accurate and complete reporting of expended materials.

- Ordinarily the firing crew will not bring more explosive to the firing mound than will be fired in one experiment. Extra explosive, or shots in a series, will be kept in a service magazine or a preparation room until the previous shot is complete. Rounds for small arms are an exception.
- Explosives handling on the firing mound should be kept to a minimum.

- All shot assemblies and support stands shall be designed to be stable once the assembly is placed on the shot stand.
- Explosive charges may be assembled on the firing mound or in the charge preparation rooms using approved glues, tapes, clamps and jigs, and chemicals, as described in the DX-4 SOP, "Operation of Charge Preparation Rooms." When necessary, argon, methane, propane, and xenon gases may be used for light generation, intensification or quenching. Chemicals not listed as permitted in preparation rooms require an SWP for use in conjunction with explosives on the firing mound.
- All firing cables, vacuum lines, electrical cables, etc., used in an explosive assembly must be protected and secured so that the shot will not move if anyone accidentally steps on or trips over the lines. It is good practice to route firing cables well away from diagnostic cables.
- Sandbags, shot design, or other measures will be used when necessary to mitigate (or control) blast and fragments per TIC-11268, DOE Manual for the Prediction of Blast and Fragment Loading on Structures, AMCP 706-181 (Army Material Command Pamphlet), and NWC-TP 5780 (Naval Weapons Center-Technical Publication).
- Whenever possible, detonators shall be attached to the explosive as a last step in the assembly of the shot.

6.5.8 Charge Protection from Weather

A cover or tent may be set up on the firing mound to shield the charge and associated equipment from the sun and weather. The Firing Leader will make sure that the cover or tent is secured against wind; if necessary, solid anchors will be used, including the anchor points on the firing chamber.

6.5.9 Unattended Assemblies

Shot assemblies may be left unattended on the firing mound during normal working hours, provided the exclusion area is cleared of all personnel, the safety gate is closed and locked, and the group office as appropriate, see 6.4.3, and Access Control Office are notified. Prudent practice dictates that the number and duration of unattended shot assemblies on the firing mound shall be kept to a minimum.

6.5.10 Working Alone

DX-4 knowledgeable employees may only work alone in an area that has an approved "working alone" procedure in the site-specific SOP for that Firing Site. When working alone with HE, employees will use the "working alone" procedure appropriate for the particular work area. The minimum requirements for working alone are given in the General Safety SOP. Performing firing operations alone has the following requirements:

- Only authorized Firing Leaders may fire explosives alone.
- All operations shall be performed in accordance with existing SOPs/SWPs.
- Working alone on firing operations is permitted only during normal working hours or when Access Control is manned.
- Personnel shall be assigned in a manner such that each worker's presence is periodically monitored via radio or a physical check, in case assistance becomes necessary.
- Any person conducting firing operations alone will be in contact with the Access Control Office.
- A Firing Leader working alone will notify Access Control before taking explosives to the firing mound.
- When a proper clearance can be accomplished and assured, Firing Leaders may conduct firing operations alone.

6.6 Safety Keys

Each safety key described in this section operates a switch that must be in the off or open position before the key can be removed. (The high-voltage disconnect key at R306 and R310 is the sole exception, because it unlocks a padlocked junction box, rather than a switch). The keys and their function described are typical. Detailed descriptions of functions are found in the site-specific SOPs.

> **Keys will never be left in unattended equipment.** This includes portable x-ray machines, 3B and 4 lasers, microwave sources, and other equipment. The Firing Leader will control keys to portable x-ray machines when people are on the firing mound.

- Firing Control Key -- Each firing circuit is locked, and each unit can only be operated with the safety key. Only authorized Firing Leaders have keys to these locks. Spare keys are locked in the Access Control key box, and require DX-4 Group Office approval for removal. These keys will be under the control of the Firing Leader during shot assembly.
- CDU Key -- The CDU key controls the power supply that furnishes the high voltage to the CDU. The Firing Leader or Chamber Operator has control of the CDU key when personnel are working on or around the firing point when explosives are present.
- Voltage Key -- The voltage key(s) control(s) all high voltage to diagnostic circuits on the firing mound.

6.7 Firing Systems

There are several firing systems used at DX-Division firing sites. Although configurations can be quite different, a firing system generally consists of a control system, a power supply (low or high voltage), a CDU, triggering units, and the connections (cables) to the detonators or EEDs. Any changes or modification to firing control equipment must be approved by the "Firing System Safety Review Panel."

6.7.1 Firing Units

Descriptions of the various types with common precautions follow:

6.7.1.1 Category I CDUs. This category is restricted to firing units where both the CDU and the high-voltage supply are located inside the firing bunker, or the CDU is in the CDU bunker. They are designed to fire several detonators on long (>5 m) firing cables. (For example, the standard 50-point unit.) All current firing units in this category attach to an external high-voltage supply. Detonator cable connections are made at the CDU after the hazard zone has been cleared and the bunker door shut, except at TA-40-8 and TA-40-5.

6.7.1.2 Category II CDUs. There are two groups of Category II CDUs, those with the HVPS remote from the firing unit, and those in which the HVPS is incorporated in the unit.

- Separate HVPS. Certain detonator types and shot assemblies must be fired with the CDU less than 2 m from the charge. These firing units have the CDU located on the firing mound. The control circuit, and HVPS, triggering unit are usually located in the bunker. The detonator may be connected to the CDU before clearing the hazard zone.
- Incorporated HVPS. Firesets with unique applications may have the HVPS incorporated into them. No firesets with self-charging capability will be used unless a site-specific SOP or a current SWP sanctions that use.

6.7.1.3 Low-Voltage Initiator Systems. These specialized systems are generally used to ignite low energy EEDs such as squibs, blasting caps, and ignitors. These operations often require an SWP, although some of these operations are covered under Site-specific SOPs for some firing sites, and do not require an SWP to be used at those sites.

- **Low Voltage CDU.** This is a low-voltage (50-V) CDU system used to ignite pyrofuse initiators, electronically initiated primers, and similar devices. This CDU has an internal supply, but it is powered through relays controlled by the firing key, arming switch, and firing switch.

- AC Firing Unit. This is an isolated 115-V ac and 300-V ac firing unit used primarily to operate solenoids that operate mechanical primers to fire guns, and to fire other experiments requiring mechanical initiation. The output is supplied by a relay controlled by the firing key, arming switch, and firing switch so that power cannot accidentally be applied at the output of the firing unit. The firing sequence is identical to that used for high-voltage CDUs. The 115-V ac and 300-V ac outputs use Reynolds 21 and 310 connectors, respectively, so that they cannot be confused with each other or with other connectors.

6.7.2 Firing Cables

Firing Cables must be clearly identified and identifiable. Care will be taken to protect these cables from damage by routing them outside normal walkways (where possible) and avoiding blast mats or other objects with sharp edges. They are separated from other cables associated with the shot as much as possible, to avoid confusion leading to misidentification, and to prevent any possibility of induction of spurious current in diagnostic cables.

- When all firing cables have been laid out, they will be taped to the shot table or otherwise secured to prevent any strain when they are connected to the detonator.
- Firing cables shall not be inserted into the CDU enclosure nor connected to an expendable CDU until people are accounted for and in protected areas, and the Firing Leader is ready to begin the arming process.

6.7.3 Firing System Interlocks

The ability to fire a shot is limited, as a safety measure, by a set of interlocks which assure that doors and gates are closed and other safety measures are met before the shot can be fired. The interlocks operate a relay that activates the high voltage power supply (HVPS) when the interlocks are made. Other interlocks activating the HVPS include a delay siren relay and a foot switch or a second hand switch. A firing key switch controls the high voltage to the firing unit(s). Details of the interlock systems are given in the site-specific SOPs. In general:

- The firing-bunker doors are interlocked with the firing circuit and must remain secured throughout the firing sequence. The sole exceptions are the Control Room doors at TA-40-5 and TA-40-8. If any special firing procedure requires the door to be open, an SWP will be written for each.
- All HVPS units used in the firing system or delivering HV to the mound will be connected to interlocked power.
- All safety systems and devices associated with firing will be checked and documented at least annually. The most recent and best schematic of the firing circuits is to be on file at the site of the operation and will be updated as required.

6.7.4 Bypass Systems

A bypass system exists at some DX Division firing sites. These bypasses may allow the CDUs to be charged and triggered without the usual audible and visual warnings and/or without closing the interlock systems. Extensive constraints on the use of these systems are described in site-specific SOPs for individual Firing Sites.

6.7.5 Final Arming and Energizing

Final arming procedures are specific to each Firing Site and are described in site-specific SOPs.

6.8 Camera and Optical Diagnostics Room

Direct optical access to an experiment can present hazards inside the firing bunker, either from port-glass shards or shot fragments. In general, rooms in which there is line-of sight access to a shot, such as through the port glass in a camera room, should be evacuated and have the door closed during shots, whenever possible. The Firing Leader may prohibit people from entering the optical diagnostics room during any given shot or operation.

6.8.1 Commercial Rotating-Mirror Cameras

Most commercial rotating-mirror cameras used in DX Division will contain any debris from a broken mirror. Even so, it is prudent practice to keep the door to the camera room closed and permit no one in the camera room when the rotating mirror in the camera is operating. This also protects operators from the noise generated by the spinning mirror. Some firing sites do not have a separate camera room, and may use commercial cameras in the bunker.

6.8.2 Home-Made Rotating Mirror Cameras

Home-made rotating mirror cameras used in DX Division are not proven to contain debris from a broken mirror. Therefore, they may only be used in a separate camera room, and it is required to keep the door to the camera room closed and permit no one in the camera room when the rotating mirror in the camera is operating.

6.9 Warning Signals

Warning signals that may consist of lights, horns, and sirens are present at all DX Division firing sites. Site-specific SOPs describe the exact warning to be found at any particular firing site.

- At all firing sites, an audible signal, a horn or siren, is sounded for more than one minute prior to firing. An "all clear" signal of two or more short blasts shall be used to denote the "all clear" condition on all operations involving a siren.

- When warning signals are tested, or if a "nonhazard" test includes warning signals, this should first be announced over the radio and public address (PA) system.

6.10 Explosive Contamination of Firing Point

If the firing point is contaminated with HE by a partial or incomplete detonation, or with pieces or powder from explosives, the point shall be decontaminated before it is used again.

7.0 PROCEDURAL STEPS

7.1 Test Assembly

- Upon delivery of explosive at the site, the Firing Leader shall make sure that the safety keys (at TA-39, the control panel key) are secured in the lock box or under the control of the Firing Leader. Keys will stay secured until the appropriate point in the firing sequence.
- When a charge is on the firing mound, the Firing Leader or an assistant will control access to the firing mound. At least one knowledgeable person shall be present at the firing site and be responsible for (ref. 6.5.9) the explosive while it is on the firing mound, or else the firing site will be closed and appropriate notices posted.

7.2 Fire Department Procedures

For shots requiring the Fire Department, the Firing Leader will contact the Access Control Office at least the day preceding the scheduled shot. The Access Control Office will contact the Fire Department and will notify the DX Division Office of the scheduled firing time and advise them that the Fire Department has been called.

- On the day of a shot, the Access Control Officer will be responsible for maintaining communications with the Fire Department according to the needs of the Firing Leader.
- When the shot is fired and clearance(s) lifted, the Fire Department is allowed to enter the area. A DX Division employee will remain on-site until the Fire Department leaves.
- Fire Department access procedures are discussed in Site specific SOPs for Firing Sites.

7.3 Clearance Procedures

It is imperative that the hazard zone be carefully cleared before any potentially hazardous operation is initiated, because people might mistakenly be within the anticipated hazard area for explosive tests. Only DX Division Knowledgeable Personnel or people accompanied by such will be allowed to remain within the hazard zone. Persons remaining within the hazard zone must be in a firing bunker or designated hardened building, and not in either a magazine or a charge preparation room, unless the preparation room is hardened.

Detailed clearance procedures for each firing site are given in the site-specific SOPs. However, a number of procedural steps and restrictions are common to all DX-Division firing activities:

- The Firing Leader will make every effort to notify the Access Control Office the day before the scheduled firing time. Posting of the Clearance Notice is the first step in assuring safe operations. Explosives shall never be moved to the firing mound for firing without notification of Access Control (if Clearance Notice was not posted).
- The extent of the clearance for a given shot is the responsibility of the Firing Leader conducting the firing operation. A Firing Leader may decide to clear to a larger hazard zone because of a larger explosive mass, a new energetic compound, a special shot configuration or fragment potential, or for any other appropriate reason.
- It is strongly recommended that there be no work done on explosives nor handling of explosives while a shot is being fired nearby.
- Simultaneous firing site clearances are discouraged for nearby firing sites. If operational necessity or efficiency requires, two or more sites may fire under the same clearance operation if the Firing Leaders determine that no unusual hazards will be created by more than one firing operation under a single clearance. However, under no circumstances shall one firing site commence a clearance while a nearby firing site is proceeding with a Firing Sequence if radio net communication may be confused, or clearance personnel may be endangered.
- More than one shot at a firing site may be fired under a single clearance for efficiency Clearance procedures in this case are site-specific. More than one shot under a single clearance shall not be permitted if a fire is probable.
- If the Fire Department is on standby, the Firing Leaders, Access Control, and the Fire Department will be in agreement that the first shot is complete and the area is safe, before the second shot can proceed.

7.3.1 Steps Before the Clearance

- Selection of clearance plan
- Determination of fire department requirements
- Posting of clearance notice and fire department notice
- Announcement of clearance (site specific)
- Briefing of clearance patrolmen and access control

7.3.2 Clearing the Firing Site (Hazard Zone)

During clearance procedures, the cleared area is established and maintained by using locked gates, interlocked gates, barricades, and/or roadblocks. The emergency warning lights on a roadblock vehicle will be operated throughout the clearance operation. The clearance procedure lists locations and procedures for closing the hazard zone. The clearance checklist will be filled out as clearance is established. Personnel remaining within the area must take shelter.

In the process of checking and clearing buildings within the hazard area, a building with all of the doors locked or external padlocks in place will be considered empty with exceptions covered in site specific SOPs. The Clearance Patrolman will enter or contact all unlocked buildings and notify the occupants, if any, of the planned shot and that they must either leave the hazard area or remain in a shelter area until the All Clear is sounded. If a building is unlocked and there is no response to hailing, then the door will be locked, if possible, from the outside, and the building will be considered empty. An unattended vehicle will be considered evidence that a person is in the hazard area, and that person must be found and directed to a safe location before the clearance is considered complete. The Clearance Patrolman will report the location(s) of all personnel within the hazard area to the Firing Leader.

When the preparation of the shot is complete, the clearance is started. During the clearance, patrolmen conduct the site-specific plan to assure that personnel are out of the hazard area or otherwise protected, and that no unaccounted for person is in the hazard zone. Specific clearance procedures generally include the following:

- Clearance checklist
- Access Control informed
- Other Firing Leaders informed, if necessary
- Clearance patrolman executes site-specific procedures, usually includes:
    - sweeps, visual and physical
    - closes gates and interlocks
    - establishes roadblocks, barricades
    - informs Firing Leader that tasks are done and the area is cleared

7.3.3 Post-Shot Procedures

- Firing staff waits for area to be cleared of explosive products and shrapnel hazard.
- Firing Leader inspects firing area.
- Firing Leader makes preliminary check for fires.
- Firing Leader declares area safe.
  With regard to explosive hazards.
- All firing staff make a thorough inspection for fires.
- Firing Leader lifts the clearance: informs clearance patrolmen and Access Control of safe area.
- Fire Department and other access allowed.

7.3.4 Unexpected Breaking of a Clearance

7.3.4.1 If anyone passes a roadblock and enters a hazard zone:
- The person manning the roadblock shall immediately notify the Firing Leader to **STOP** the firing sequence.
- The person manning the roadblock shall remain at his station and shall not attempt to chase the persons who have passed the roadblock.
- The Firing Leader shall immediately discontinue the firing sequence and confirm receipt of the message.

7.3.4.2 If any Firing Point interlock is opened, the Firing Leader must:
- immediately discontinue the firing sequence and investigate.
- reclear the area before restarting the firing sequence.

7.3.5 Clearance Outside Normal Working Hours

- If a shot will be fired outside of the normal work day (8:00 AM to 4:00 PM), or if explosives will be left overnight, the Firing Leader will notify the Access Control Office, Access Control will call DX-DO, PTLA, and EM&R. Clearance procedures modified under an SWP may be used for shots fired outside normal working hours.
- For a late shot, or if explosives are left overnight on a firing pad, the firing area access gate will be left in the closed position. When the hazard zone extends beyond the boundaries of the site at which the shot is to be fired, a more extensive exclusion area will be used.

7.4 Detonator Connections and Arming

Arming begins when any part of the firing system is energized. Arming commences only when clearance procedures are completed.

7.4.1 Continuity Measurement (Resistance Measurement, "DCOing")

Resistance of a detonator is checked only with a meter (DCO) certified by DX-1. This step may also be undertaken before clearance is established.
- **Category I CDUs:** Usually the resistance of the detonator and cable is measured from within the bunker, just before hooking the cables to the CDU. The clearance is in place.
- **Category II CDUs:** The resistance of a detonator and cable is measured on the firing mound, before connection to the fireset or during connection to the fireset (depending on the connector type.)

HV monitor cable is connected to both the CDU and the HV monitor to assure that no HV is on the CDU.

3. With the Firing Leader's authorization, connect the detonator cable to the CDU.
4. After the hazard area has been cleared and the firing sequence started, connect the high-voltage supply to the CDU from within the firing bunker.
5. After the shot, check the high-voltage monitor to ascertain that the CDU is totally discharged. Disconnect the high voltage supply, monitor, and trigger cables.

7.5 General Firing Steps

The following steps illustrate the procedural steps used for firing shots. Exact procedures are found in the site-specific SOPs.

7.5.1 Using a Category I CDU

- exclusion area cleared
- detonators connected to cables (not to CDU)
- final alignment check
- everyone inside, door shut, dropouts set
- interlocks shut, made
- safe condition to fire ascertained (interlocks, observation)
- firing sequence engaged (computer timing sequence, if present)
- DCO
- firing cables connected to Cat. I CDU (CDU inside)
- siren runs for 1 min. or more
- ready-fire switch closed (footswitch or handswitch)
- HV applied to CDU
- Shot is fired
- check that CDU discharged
- allow time for fragments to fall
- disconnect firing cables
- allow prudent time for detonation product gases to clear before going outside.
- all clear- 2 or more short blasts
- complete post shot operations

7.5.2 Using a Category II CDU

- exclusion area cleared
- detonators connected to cables (not to CDU)
- final alignment check
- connect the detonators cables to CDU (with at least one interlock open)
- everyone inside, door shut, dropouts set

- safe condition to fire ascertained
- CDU connected to HVPS and trigger (CDU outside)
- Firing Leader makes connections as last step, then retires to firing bunker.
- computer timing sequence, if present, engaged
- siren runs for 1 min. or more
- ready-fire switch closed (footswitch or handswitch)
- HV applied to CDU
- Shot is fired
- allow time for fragments to fall
- all clear- 2 or more short blasts
- check that CDU discharged, especially if outside
- disconnect firing cables
- allow prudent time for detonation product gases to clear before going outside.
- complete post shot operations

7.6 Special Procedures

The following gives the procedures used for situations that occur occasionally during firing operations.

7.6.1 Misfires

- In case of a misfire, reduce the firing voltage to zero. Check the HV monitor to be sure that the CDU(s) is discharged.
- Turn off the camera/turbine supply (if in use). Once all the circuits are deemed safe and the appropriate firing system cables have been disconnected, personnel shall first attempt to view the firing pad through the optical port or through the camera periscope. Without terminating the firing sequence, look for possible obvious causes (such as an unconnected detonator cable).
- At this time, the firing cable and detonator(s) may be checked for continuity, if possible. This check will be done from within the safety of the bunker. If it is necessary to go to a CDU bunker to do this check, the ten minute wait described below must be completed before the CDU check.
- One or more attempts to fire may be made, at the descretion of the Firing Leader. If the shot still does not fire, inform Access Control and wait ten minutes. Visual inspection may be performed by the person blocking the road, or a person coming from outside the exclusion area to a safe distance from the mound. If it is necessary to go to a CDU bunker to do this check, the Firing Leader and one other person may go, after waiting for ten minutes.
- Be sure the CDU is disarmed before approaching the shot. Before other personnel are allowed to leave the cover of the bunker, one qualified person shall carefully approach and examine the setup to verify that it is safe.

- If an unexpected situation develops on the firing pad posing apparent danger, seek safety inside the bunker then notify the Access Control Office.
- For shots at elevated temperatures, 10 minutes may be an insufficient wait time, and Group Management should be consulted before anyone ventures near the firing mound.

7.6.2 Partial Firings

In the case of known or suspected partial firing, all personnel will remain inside the bunker. Notify the DX-4 Group Office and Access Control. A 30 minute waiting period shall be observed. If the explosive is burning, or if there is smoke in the general vicinity, wait at least 15 minutes after these signs have disappeared before approaching the assembly. The following steps and precautions shall be followed:

- Notify Access Control and the DX-4 Group Office.
- Continue to run siren.
- Disconnect and deenergize all electrical power sources connected to the shot, and turn off the camera/turbine supply (if in use). Disconnect all firing cables (and/or charge and trigger cables) from the CDU, where feasible
- Ensure that all personnel in the hazard area are aware that a failure has occurred and that they must remain under cover until notified otherwise.
- Check all possibilities for the cause of the test failure from inside the bunker. When all circuits are deemed safe, attempt to view the shot via the port glass or camera periscope. Alternately, a person can view the firing mound from a safe distance.
- Before any personnel are permitted to leave the cover of the bunker, a 30-minute waiting period shall be observed.
- A carefully prepared review of the situation in consultation with another knowledgeable person such as line management, a line supervisor, or the ES&H Coordinator should be initiated.
- Before personnel are allowed to leave the cover of the bunker, one qualified person shall carefully approach and examine the setup to verify that it is safe.
- In the event of an expected test failure containing only detonators or actuators and no HE charge, a 5 minute waiting period shall be observed before going out onto the firing mound.

See the DX-4 SOP, "Firing Small- and Large-Bore Guns" for procedures covering shots involving projectiles (bullets, shaped charges, etc.) that are fired into targets containing energetic material.

7.6.3 Disconnecting

- The Firing Leader and no more than one assistant will disarm all shots.

- The Firing Leader and the assistant (if present) will observe and certify on the Firing Point Checklist that all firing cables are disconnected from the CDU. Cables are removed from the CDU chamber or firing bunker (whichever is appropriate).
- If a Category II CDU is being used, disconnect and short the high-voltage supply cable and the trigger cable.

7.6.4 Aborted Shots

Either the experimenter or the Firing Leader decides if a shot should be aborted. Both together determine weather the explosives assembly is safe for return to storage.

7.6.5 Firing Sequence Interrupt or Shutdown

In some cases, it may be necessary for the firing procedure to be interrupted or reversed (e.g. a person intrudes into a hazard area or equipment has malfunctioned). If any of these instances should occur, follow the steps listed in the site-specific SOPs. In general:

- Release the redundant ready-fire switch (foot switch or hand switch).
- First turn off the HV key switch. This allows the voltage to return to zero.
- Check the HV monitor to be sure that the CDU(s) is discharged.
- Disconnect all DET, HV, power supply, and trigger cables going to the firing pad, as appropriate.

Firing will be prevented if the drop-out relay of the firing site safety gate interlock circuit or any other interlock is not in a closed position. This can occur because someone has entered the area after the gate was closed. **Do not resume the firing sequence until a complete check of the area inside the gate has been made.** After such a check, the interlocks can be reset and the firing procedure repeated.

7.6.6 Rotating Mirror Cameras

In general, it is prudent practice to stay out of the camera room and leave the camera room door shut when the mirror is running and for one minute after the camera air is turned off, or until the mirror has stopped rotating.

Many rotating mirror cameras have mirrors made of beryllium, which is poisonous when present as a dust. If it is determined that a beryllium mirror has broken while in operation, do not open the camera room door or the camera housing. Turn off the camera air and high voltage. Evacuate the building and do not reenter until ESH-5 has evaluated any possible hazards and given permission to reenter. If the housing of the shut down camera needs to be opened to determine that the mirror has failed, leave the room as soon as the failure is apparent.

7.7 Emergency Procedures

7.7.1 Building or Site Emergency

If an emergency situation should occur, follow the Building Emergency Plan (BEP)/Site Emergency Plan (SEP). The BEP/SEP must be available in the building and the operators shall be familiar with its contents.

7.7.2 Personal Injury

In any emergency involving injury to a person or persons, the employee encountering the accident should use good judgment on the procedures to be followed, depending on the circumstances. Decisions made by a DX employee at the scene of an accident will be supported by the DX management. If there is a serious injury or accident, follow this procedure:

1. Dial 911 to contact the Fire Department Rescue Squad and ambulance. Say where the emergency is and stay on the line until the operator has finished getting information from you.

2. Aid victims if possible, but do not endanger them, yourself, or others. Request first aid and CPR help if needed. Take measures necessary to prevent further damage or injury.

3. Dispatch individuals to direct emergency vehicles.

4. Notify the Group Office. The Group Office will:
   - notify the DX Division Office,
   - alert guard stations to expect emergency vehicles and personnel:
   - For TA-15: Station 431 (7-4850)
   - For TA-36: Station 460 (7-4051)
   - For TA-40: Station 431 (7-4850)
   - TA-39 Local Access Office personnel will open the main gate to the site, to allow emergency vehicles to enter.
   - call the FMD (Facility Manager Designee) at 8-1-(505) 699-1765.
   - call the Emergency Management Office to notify them of the incident (7-6211 during working hours, 7-7080 after hours).

5. Inspect the accident site to see if anything might cause injury to rescue personnel. If possible, consult with the Group Leader or other senior DX-4 employees. Otherwise, the people at the accident scene have the authority to proceed or limit access at their discretion. Fires involving explosives, or imminently involving explosives, will not be fought. All personnel will instead seek shelter in a bunker.

6. Continue to give first aid until the Rescue Squad arrives.
7. Record accident details including personnel involved, injuries, property damage, and witnesses.
8. Remain at your regular location if you are not directly providing aid.
9. Do not disturb evidence that may be important for later investigation.

7.7.3 Electrical Shock

Any employee who receives an electrical shock must report to ESH-2 for evaluation.

7.7.4 Lasers

Any employee who receives an injury from a laser must report to ESH-2 for evaluation.

8.0 REQUIRED RECORDS

- Shot request form
- Shot schedule
- Expended materials reports
- Explosives Inventory Reports
- Post-Shot Reports (on file at TA-15-183 Access Control)
- Site Log Books, if applicable
- Clearance checklists (on file at TA-15-183 Access Control)
- Firing checklists

9.0 REFERENCES

- DOE Explosives Safety Manual, DOE M440.1-1, REV 8
- Army Material Command Pamphlet, 706-181 (Blast and Fragments)
- DOE Manual for the Prediction of Blast and Fragment Loading on Structures, TIC-11268
- Naval Weapons Center-Technical Publication, 5780 (Blast and Fragments)
- LANL Electrical Safety Program
- DX Division Operations Manual
- DX Division Training and Qualifications Manual
- Building/Site Emergency Plans
- DX-10: SOP 71, "Exposure of Explosive to Elevated Temperature"
- Los Alamos National Laboratory ES&H Manual
- DX Division SOP 6, Radiological Controls

- SOP DX-11-2.5, "Firing Small- and Large-Bore Guns."
- DX Division SOP 1, Hazardous Waste
- Los Alamos National Laboratory's *Environment, Safety and Health* Manual Administrative Requirement (AR) 6-6, "Explosives," (AR) 12-1, "Personal Protective Equipment," and (AR) 7-1, "LANL Electrical Safety Program."

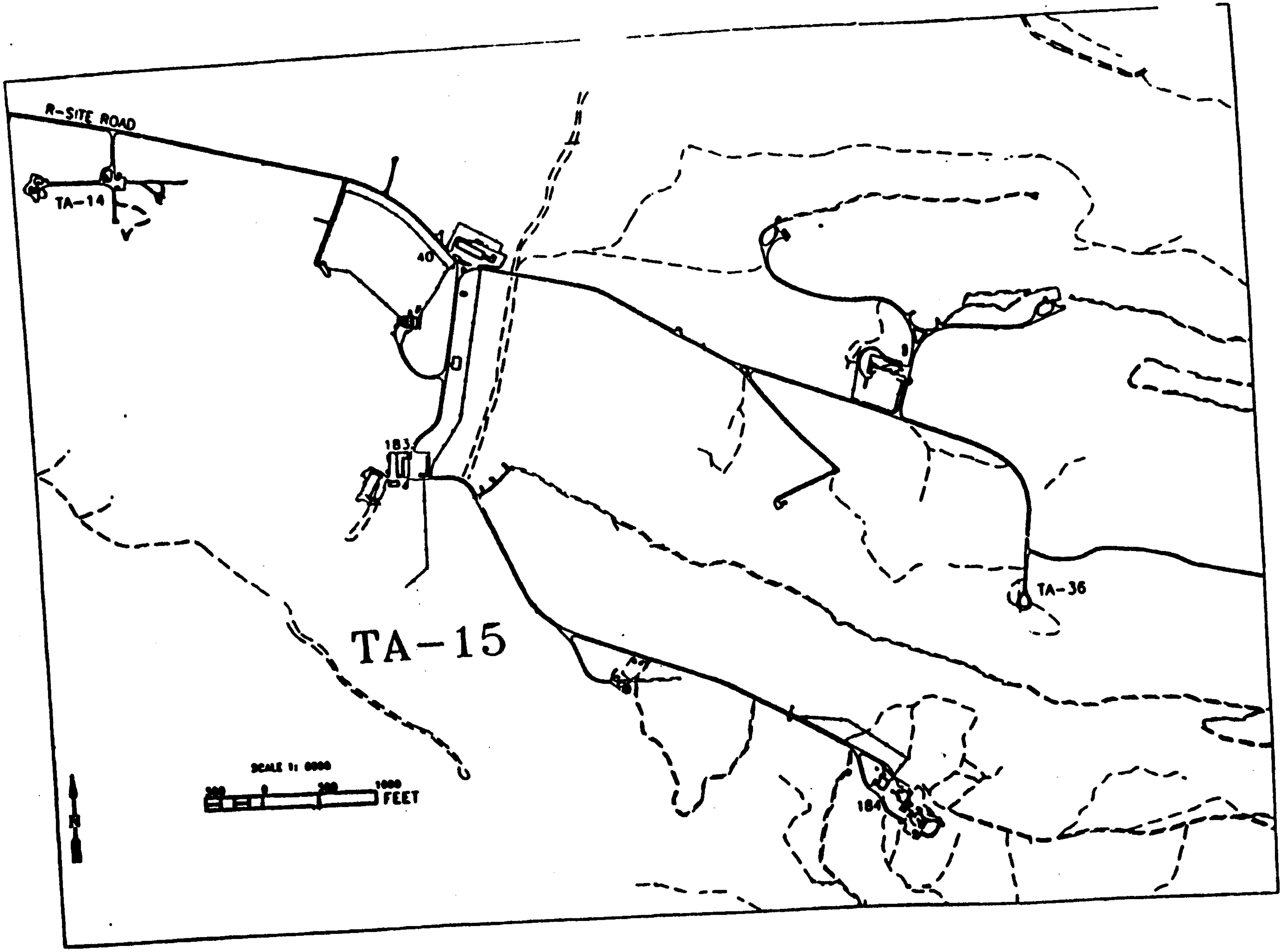
10.0 ATTACHMENTS

ATTACHMENT 1: Maps
ATTACHMENT 2: Soldering, details of operations
ATTACHMENT 3: Specific Hazard Circles and Clearance Plans
ATTACHMENT 4. Equipment Approved for Use on the Firing Point During the Setting of a Shot

ATTACHMENT 1

Maps

Attached:
- TA-15
- TA-14/16
- TA-39
- TA-40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TA-15
TA-36
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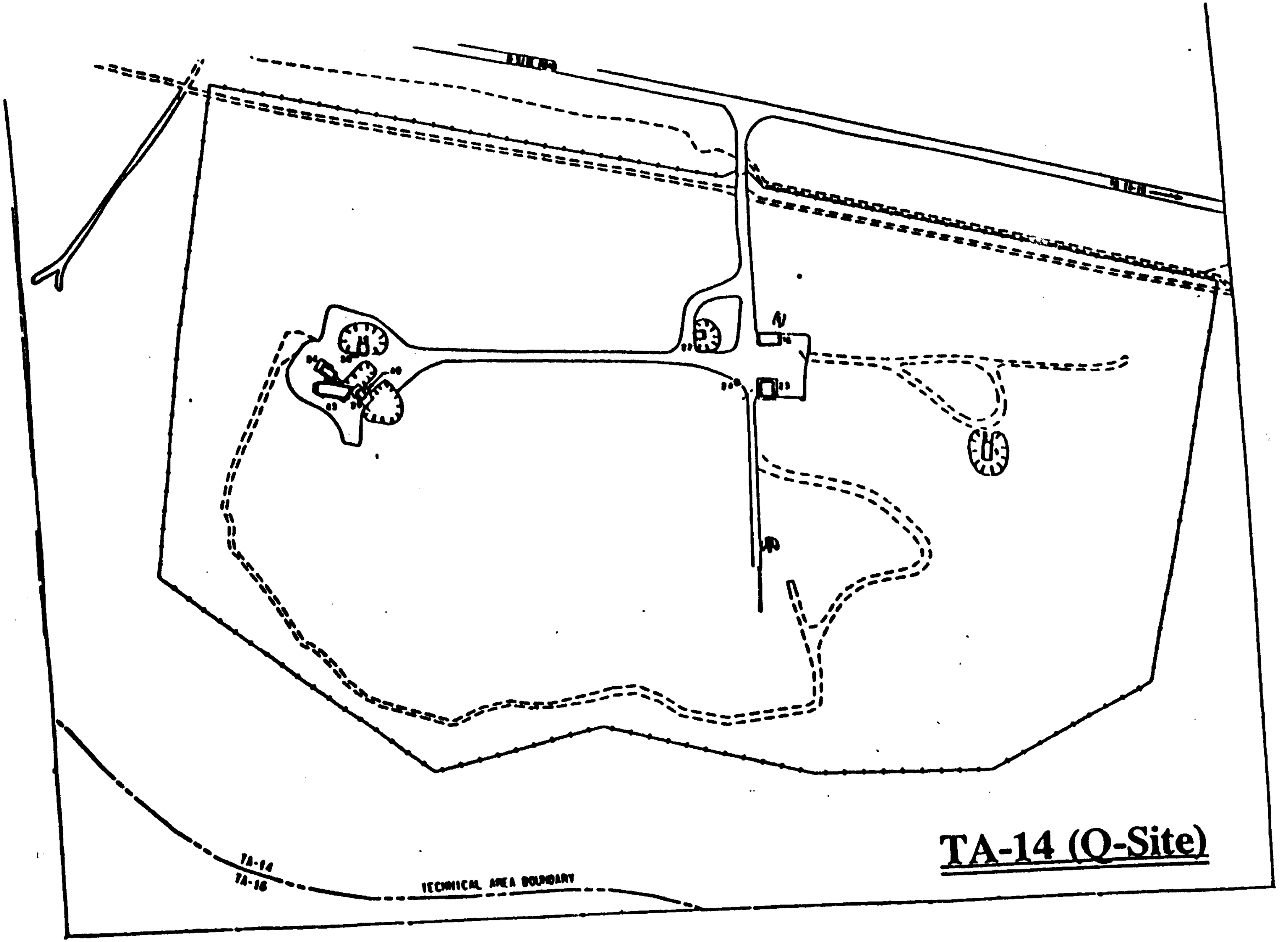
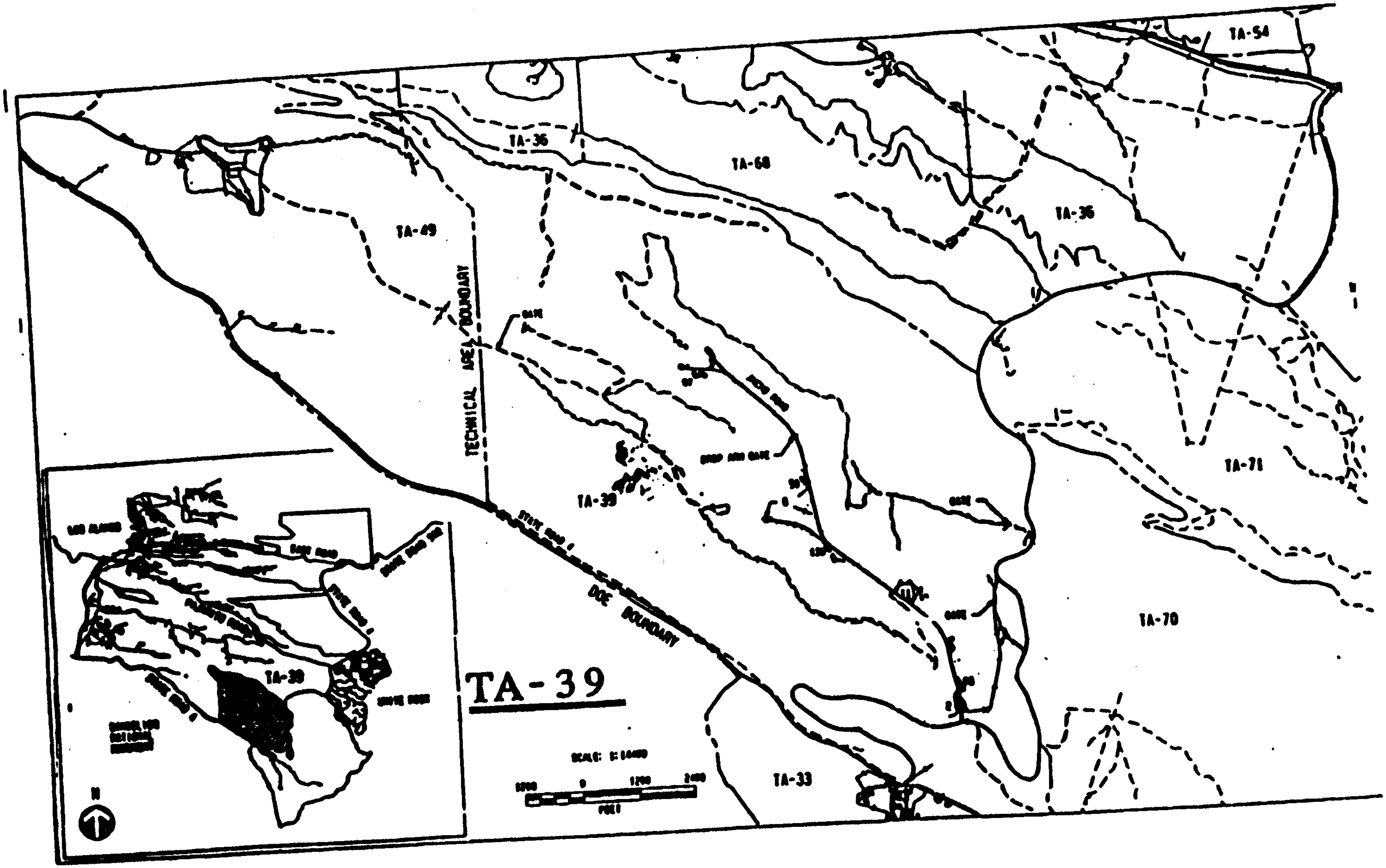
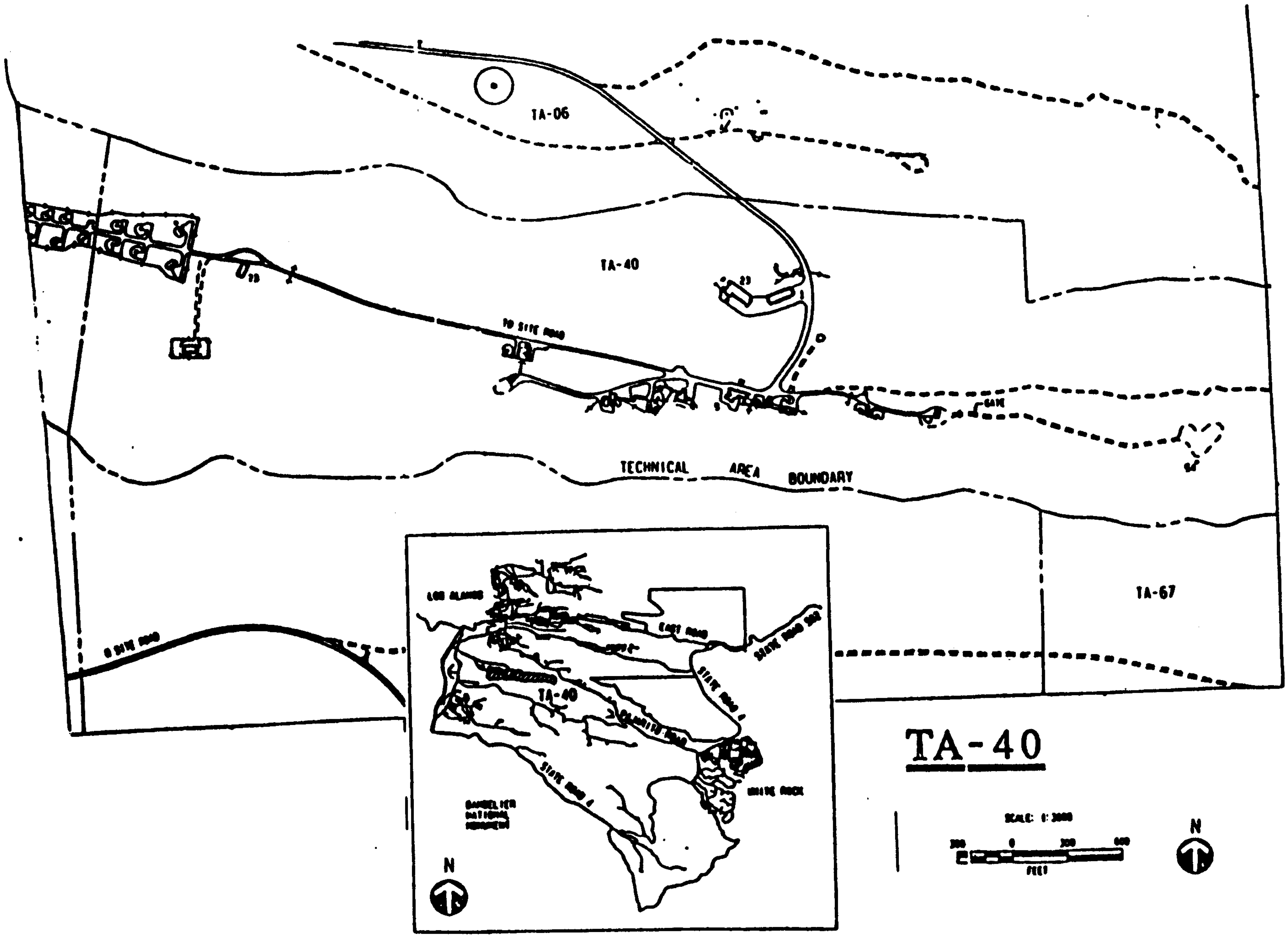


TA-14 (Q-Site)


TA-39
TA-54
TA-36
TA-68
TA-36
TA-49
TA-71
TA-70
TA-39
TA-33
TECHNICAL AREA BOUNDARY
DOE BOUNDARY
STATE ROAD 4
GATE
TA-39
N


TA-06
TA-40
TO SITE ROAD
GATE
TECHNICAL AREA BOUNDARY
TA-67
LOS ALAMOS
EAST ROAD
STATE ROAD 502
STATE ROAD 4
TA-40
WHITE ROCK
BANDELIER NATIONAL MONUMENT
N
SCALE 1:3000
FEET
N

TA-40

ATTACHMENT 2

Soldering, Details of operations:

As a final step in constructing the shot assembly, it may be necessary to solder electrical leads to it. This operation must be performed carefully, using a soldering gun with a momentary switch, a battery-operated soldering tool, or other soldering gun that does not remain hot when not in use.

The Firing Leader is responsible for ensuring that only proper soldering equipment is used.

The hot tip is always kept at least 30 cm (1 Ft) meters from any bare exposed explosive(s) and is kept one meter or more from any exposed explosive(s) when not in use.

The soldering iron, and especially the flexible cord, must be examined for defects before it is used.

Any AC soldering gun used at a firing site must meet UA and OSHA standards for electrical safety.

All personnel who use soldering equipment near explosives must be aware that heat could reach the explosive by conduction. All soldering operations shall be performed so that material in contact with the explosive never becomes more than warm to the touch.

Interposed barriers must be used to ensure that neither the hot soldering iron nor molten solder dropping from it comes in contact with the explosive.

Soldering directly to pins or other objects that are in contact with explosives and can conduct heat to the explosive is prohibited.

Whenever possible, soldering operations shall be done beside or below the assembly rather than above it.

When soldering is completed, the soldering gun must be unplugged and placed in a stable position at least 60 cm (2 ft) from any exposed explosive.

ATTACHMENT 3

6.2a.5 Table of Hazards and Hazard Circles for Clearance Plans at TA-15 and TA-36

Plan	Hazard Radius	Application
A-Minor	75 m (250 ft)	Contained detonator firing. Pulsed-power discharges. Radiation production. Firing-point access control. Small-arms firing.
A-Minor Special	75 m (250 ft)	Contamination control. Specific to PHERMEX.
A	250 m (1250 ft)	Explosive shots.
B	500 m (1640 ft)	Explosive shots.
C	750 m (2460 ft)	Explosive shots.
C Special	750 m (2460 ft)	Contamination control. Confined shots with potential for a hazardous material release. Specific to PHERMEX.
D	1000 m (3280 ft)	Explosive shots.
E	1250 m (4100 ft)	Explosive shots.

TA-39:

Clearance Plans - Each test using HE must be evaluated by the shot leader to determine its hazard potential and what safety plan must be used The safety plans listed below are in ascending order as risk increases. For new operations, or for those with which we have little experience, the highest reasonable hazard level shall be chosen. Each safety plan uses barriers to control traffic. Barriers may never be crossed without explicit permission of the Firing Leader.

TA-39:

Level-1. Level-1 hazard areas are approximately 46 m (150 ft) from the firing points and have barricade with a sign stating "Level-1 Hazard - Do Not Pass." Operations that do not involve the detonation of HE may be conducted using Level-1 safety plan (see SOP DX-15-55). In general, the firing of detonators requires Level-2 (or higher) safety plan; however capacitor bank operations may use a Level-1 plan. This safety plan is also used to exclude personnel from the firing pad when HE is present and there is no hazardous operation in progress.

Level-2. Gate 2 located 750 m (2460 ft) from Point 57, labeled "Level-2 Hazard Area - Do Not Pass," defines the hazard area for the safety plan available for shots meeting the general criteria or explicitly listed in Attachment 1.

Level-3. Systems that do not meet the criteria for a Level-2 hazard are automatically Level-3 hazard shots. Gate 3 (near the entrance to Firing Point 6) provides a hazard circle of 1350 m (4400 ft). This gate is labeled "Level-3 Hazard - Do Not Pass.

Level -4. Shots that have the following properties should use the gate labeled, "Gate 4 - Do Not Pass," unless there is specific experience with the system or rather extensive shrapnel mitigation techniques are being used.

Confined explosives systems with more than 100-lb. HE and having metal (e.g., steel, Cu) walls of 2 in. thick or more.
Shots with completely random shrapnel containing more than 100 lb. of HE.
Shots with heavy metal shrapnel that must be directed down the canyon.

NOTE: Remember that State Road 4 is closer to the firing points in two locations than Gate 4, and TA-36 firing points are roughly the same distance from Gate 4 but in the opposite direction. If the shrapnel in the specific shot in question cannot be directed away from the road with certainty, extra mitigation for shrapnel in these directions must be used.

Level-5. A final option is to close the gate labeled, "Gate 5 - Do Not Pass." One may utilize this closure option when particle trajectories will be in the direction of the explosive magazines and extensive shrapnel mitigation measures have been taken to protect State Road 4 and TA-36. The shrapnel mitigation measures must be in place before the HE-containing assembly is brought to the firing area, or must be installed simultaneously with the placing of the HE. The closure of Gate 5 provides additional personnel protection within Ancho Canyon. A safety plan using Gate 5 to define the hazard area will be approved by the Group Leader and the Safety Committee

TA-40 Hazard Circles

Chamber 15	The hazard circle for Chamber 15 extends from the safety gate.
Chamber 5	The hazard circle for Chamber 5 is defined by the confinement on the firing pad, because of the very small load limit at this chamber.
Chamber 4	The hazard circle for Chamber 4 extends from the safety gate.
Chamber 8	The hazard circle for Chamber 8 is defined by the Firing Vessel. There is no hazard area outside the Firing Vessel.

ATTACHMENT 4

EQUIPMENT APPROVED FOR USE ON THE FIRING POINT DURING THE SETTING OF A SHOT

1. Portable electric screwdriver or drill motor.
2. Normal hand tools such as hammers, screw drivers, pliers, saws, wrenches, tape measures, and knives.
3. DCO meters approved by DX-1 for checking resistance of detonator bridge-wires.
4. Battery-operated V/Ohm meters to check continuity in cables and circuits isolated from explosive.
5. meters to check for shorts in explosive-monitoring pin and foil circuits.
6. Scintillators with incorporated power supplies.
7. Sources for checking scintillators.
8. Soldering gun (see Attachment 2).
9. Telephone, microphones, and loud speakers.
10. Vacuum pumps and gauges.
11. Pressurized bottled gases, regulators, and gauges.
12. Cameras. (see the DX-4 SOP, " Shot Illumination.")
13. Optical alignment apparatus. Mirrors, lasers up to class 3A.
14. Films, intensifier screens, and cassettes for radiography.
15. Electric water heater (element not exposed).
16. Radios.

Optical equipment, flashlamps and lasers are discussed in detail in the DX-4 SOP on Shot Illumination, or in the DX Division Laser SOP.

General Firing Operations Tools typically used on Firing Mound

Hammers	Crimpers	Cutting Tools
Wrenches	Handsaws	Circular Saw
Socket sets	Files	Jig Saw
Screwdrivers	C-Clamps	Drill Motors
Levels	Tape Measures	Alignment Lasers
Squares	Pry Bars	Impact Wrenches
Chalkline	Chisels	Volt Ohm Meter
Pliers	Micrometers	

DX-4

PREPARATION ROOM OPERATIONS

EXPLOSIVE CHARGE HANDLING

ASSEMBLY

SOP 5

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J. M. McAfee, DX-4 Group Leader

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ESH Deployed Team Leader

Approved by: C. M. [illegible] Date: 12/20/96
DX-DO

Controlled Document Number:

Table of Contents

1.0 INTRODUCTION

This SOP describes the methods to be used in the preparation of explosive charges for firing at DX Division firing sites. Explosives handling, assembly, measuring, trimming, and gluing operations are discussed. All requirements of this SOP are in accordance with the DOE Explosives Safety Manual. Long-term storage is described in the DX-4 SOP, "HE Storage."

2.0 PURPOSE

This Standard Operating Procedure (SOP) provides guidelines and rules for the safe performance of the operations used in the preparation and assembly of explosive charges in DX Division charge preparation rooms. It describes the precautions and procedures for safely performing explosive charge preparation operations.

3.0 SCOPE

This SOP covers all explosive assembly and preparation operations at DX Division Preparation Rooms. This SOP applies to all personnel who are authorized to perform operations in DX Division charge preparation rooms.

Location of charge preparation rooms at TA-15 and TA-36:

Building TA-15-242
Building TA-36-4, Room A (Eenie Site)
Building TA-36-5, Room A (Meenie Site)
Building TA-36-7, Room A (Minie Site)
Building TA-36-11, Room A (Lower Slobbovia)
Building TA-36-82 (Daisy Mae-Kup)

Assembly and preparation areas at TA-40:

Building TA-40-14 serves Firing Chamber 15
Building TA-40-11 room 106 is administered by DX-1 as part of crystal growing operation at TA-40-12
Building TA-40-6 serves Firing Chamber 5
Building TA-40-41 serves Firing Chamber 4, and miscellaneous large shots
Building TA-40-3 is administered by DX-1, as a part of gas gun operations.

Assembly and preparation area at TA-14 Q Site is

Building TA-14-23 room 104.

Shot preparation facilities at TA-39 are:

Building TA-39-4	trim shack
Building TA-39-111	shot assembly building
Building TA-39-77	propellant assembly for gas guns, is administered by DX-1.

Ignorance of the contents of an SOP does not excuse any violation. Any confusion regarding an SOP should be clarified before an operation begins.

In situations where an approved SOP cannot or should not be strictly adhered to, the SOP must be revised or a deviation be formally approved in an SWP.

4.0 DEFINITIONS

- **Approved explosive, propellant, or detonator** - Those detonable materials which DX Division allows in magazines, preparation rooms, and operations. Approved explosives are listed in Attachment 1 of this SOP.
- **Assembly** - Operations that involve installing explosives as part of an experimental assembly.
- **Assembly Building** - A large preparation room (TA-39-111) designated for the assembly of large systems containing explosives. The Assembly Building may be used for explosive storage under rigid restrictions. Only the HE for the assembly being worked on may be in the assembly building.
- **EED** - Electroexplosive Device
- **EP** - Explosion Proof
- **ERC** - Explosive Review Committee. A laboratory committee that has final authority on many explosives safety issues within the Laboratory, including acceptance of explosives not on the "Approved Explosives" list.
- **MSDS** - Material Safety Data Sheet
- **Explosives** -- Explosives are defined in the *DOE Explosives Safety Manual* as any chemical compound or mechanical mixture that will burn or explode if heated, exposed to impact, pinched between moving surfaces, or subjected to an electric discharge or strong shock. The term applies to materials that either detonate or deflagrate. Because explosives do not all behave in the same way, they are divided into classes. Those of most interest to DX Division are initiating, boostering, and bursting-charge (secondary) explosives, propellants, and some types of military ammunition. A list of approved explosives is given in Attachment 1.
- **Explosives Allowed Area** - Any area where explosives or explosive-containing components are stored, manipulated, prepared, or set up for firing.
- **Explosives Excluded Area** - An area where no explosive, explosive contamination, or operations with explosives are allowed. Generally, these are firing and diagnostic bunkers, offices, and buildings not specifically designated for explosives use or operations.
- **Explosives Load Limit** - The amount of explosives permitted in a magazine or preparation room, as posted on the building of each magazine or preparation room.
- **HE** - High Explosive

- **Incompatible materials** - Materials that may produce unsafe conditions when in contact with explosives. Glues and solvents are commonly encountered incompatible materials.
- **Knowledgeable Personnel**: A knowledgeable person (includes "knowledgeable visitors") can only be designated by the DX-4 Group Leader or the DX-4 Deputy Group Leader. All other personnel are visitors. Knowledgeable persons have at least four months experience working in a firing area, as verified by the DX-4 Group Leader. They have met the training requirements stipulated by DX-4, and are judged competent to safely perform various assigned tasks. Knowledgeable Personnel are eligible for pictured exchange badges where they are required. All required reading, institutional training and OJT requirements must be completed before becoming a knowledgeable person or employee. These requirements are specified in Site Specific SOPs or the Authorizations and Assignments Document. They may escort visitors.
- **Low Energy EEDs** - Hot-wire initiators, squibs, blasting caps, etc.
- **Magazine, Storage Magazine** - A structure designed for long term storage of explosives. No operations may be carried out in magazines.
- **Personnel Limit** - The number of personnel allowed in a magazine or preparation room for either explosive operations or inspections. The personnel limit is posted on the door of each magazine.
- **Preparation Areas** - Rooms and buildings designated as explosive preparation and assembly areas.
  NOTE: If necessary, the firing pads may be used as preparation areas for final assembly. If this is done, extra caution must be exercised since there are steel floors and uneven surfaces.
- **Storage** - Operations that involve storing explosives until time for its use. During storage, no operation may be done to the HE.
- **Suitable Storage Container** - A container for storing explosives that is constructed according to the DOE Explosives Safety Manual, II.17.5 under "approved containers."

5.0 RESPONSIBILITIES

5.1 Required Reading

5.1.1 Each employee who holds a key to, or uses explosives preparation rooms in DX Division must read this SOP yearly, and should suggest and review revisions to the SOP as required.

5.1.2 Line supervisors will be responsible for determining which SOPs are required for their employees.

5.2 Training

All training is to be in accordance with the DX Division Training and Qualifications Manual.

5.2.1 Personnel Training Requirements. Personnel with less than four months' training with explosives at DX Division may work in a preparation room only under the direct supervision of a qualified group member who has been granted access to the preparation room.

The DX-4 Group Leader or Deputy Group Leader may waive this requirement for individuals with other pertinent experience and knowledge.

5.2.2 The team leaders will determine, with input from the Group ES&H officer and the Division Training Generalist, what type of training is required for their team members.

5.2.3 Required reading is an important part of each employee's training and qualification. All employees shall be required to read and understand all the appropriate SOPs and other procedures for each assigned task and for each piece of equipment that they use. A required reading list will be maintained for each employee by the Group ES&H Officer and will be part of the employee's qualification, if required.

5.2.4 The line supervisors are responsible for on-the-job-training, detailed instruction, and monitoring of the operators' competence and adherence to instructions.

5.2.5 Documentation of on-the-job-training (OJT), and job-related or job-required training will be maintained by the Division Training Generalist in individual training files.

5.3 Waste Minimization

5.3.1 Waste minimization will be handled according to the Waste Minimization section of the DX Division Operations Manual and the LANL ES&H Manual, AR 10-8.

5.3.2 Waste generated from Prep Room operations must be reduced as much as technically and economically feasible. To meet this objective, the waste minimization practices of frugality, material substitution, and hazard segregation must be incorporated into waste generating activities in Prep Rooms. All operators should make every practical effort to reduce the amount of waste produced.

5.3.3 All waste will be handled according to the DX Division Waste Management SOP, DX Division SOP 6, Rad Con, DX Division SOP 1, Haz Waste, and the LANL ES&H Manual, AR 10-3.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Hazards

The principle hazards associated with explosive operations are blast, fragment production and propulsion, and rapid deflagration (burning) of the explosive charge or assembly. Explosives can develop violent chemical reactions from such stimuli as being heated, burned, impacted, or dropped. Even small quantities may pose a life threatening hazard.

Explosives will be protected from abnormal stimuli or environments, including:
- friction forces
- excessive pressures
- impact, shock, pinching
- deformation
- electrical sparks, abrasive or welding sparks, open flame
- contamination.

Explosives may be toxic, irritant, or provoke a skin rash or other physiological effects. In particular, propellants and materials containing nitroglycerine can have a physiological effect, and gloves should be worn when handling these materials. Personnel should contact their supervisor and ESH-2 should symptoms arise. Personnel shall wash their hands after handling explosives, especially before eating or smoking. In addition, when assembling and preparing explosive charges, the potential exists for exposure of personnel to solvents, glues, and other chemicals that may be irritating or harmful. Hazards from contact, ingestion, or inhalation are listed in MSDSs for the explosives and chemicals in question, which are available at the Preparation Rooms. Personnel should be familiar with the MSDSs for the explosives and chemicals they use. These chemicals are used in small quantities which normally do not require ventilation hoods.

Personnel must ensure there is adequate ventilation when required.

6.2 Handling of Explosives: General Precautions

- Handling of HE should be minimized.
- Explosives shall be kept in a stable position, away from the edges of workbenches, tables, and away from other objects which may tip or fall onto them.
- After an operation on an item has been completed, the item must be placed in a secure location and left in a stable configuration. When possible, items should be placed in suitably designed containers. **An item must not be left in any position at any time where it can be easily toppled.**
- Special care shall be taken to prevent and protect explosives from dropping, bumping, or scraping.
- The distance that an item will fall if accidentally dropped must be minimized.
- Floor areas where the handling of HE items is most likely to occur should be covered with an approved tile to reduce the danger in the event of an accidental drop. Floors must be kept clean, to prevent abrasion should a part be dropped.
- Hard surfaces or sharp edges that could be struck by a bare piece of HE in the event of an accidental drop should be padded or otherwise protected.

- The sliding of bare HE on surfaces should be avoided because HE surfaces are relatively susceptible to marring by scratching or slipping. This is important from a quality as well as from a safety standpoint.
- The work area surrounding an HE item that is to be handled shall be kept clear of extraneous tools, components, fixtures, and the like that could interfere with handling operations.
- An explosive sign or placard shall be placed on or next to all unattended explosives.
- All explosives shall be transported in accordance with the DX Division Packaging and Transportation SOP.

Limitations

- Mechanical force cannot be applied in such a manner that stress concentrations are developed in explosive parts, e.g. a sharp object in contact with the explosives.
- Mechanical clamps cannot be used in a manner that creates sufficient tensile stresses within the explosives to cause fracture.
- Abrasion of explosive charges by rough or sharp edges is not allowed.
- Hair felt material is not to be used with Detasheet because it builds static charges.
- Acetone is used directly only on particular explosives, and only with caution. In general, no solvents should ever be poured on explosives.

6.3 Personnel and Explosives Load Limits

Each Explosives Preparation Room has a maximum limit on the amount of explosive that can be present during normal operations. The limits for DX Division Preparation Rooms are listed on the door of the Preparation Room.

Personnel limits are established to prevent crowding of the preparation room from causing an accident, and to limit casualties in case of an accident.

The DX-4 Group Leader may approve a temporary change in occupancy limits.

6.3.1 Personnel and Explosive Load Limits at TA-15 Preparation Room

Building No.	Person Limit operators/casuals	Explosives (lbs)
TA-15- 242	4	200

6.3.2 Personnel and Explosive Load Limits at TA-36 Preparation Rooms

Building No.	Person Limit operators/casuals	Explosives (kg)
TA-36-4	4	100
TA-36- 5	4	100
TA-36- 7	4	100
TA-36-11	5	100
TA-36-82, each room	5	100

If the weight of a single shot exceeds the specified limits or if a shipment must be received that exceeds the specified limits, the DX-4 Group Leader may approve an increase to 250 kg in Buildings 4, 5, 7, and 11 for up to two weeks. These actions must be recorded in the Site Record Log Book.

6.3.3 Personnel and Explosive Load Limits at TA-39 Preparation Rooms

Building	Persons Limit operators/casuals	Explosives (lbs)
TA-39-4 Trim Shack	6	500
TA-39-111 Assembly Building	9	1000

6.3.4 Personnel and Explosive Load Limits TA-40 The personnel and explosive load limits for the Prep Room facilities used by DX-4 are listed below.

Building No.	Person Limit operators/casuals	Explosives (kg)
TA-40-6	5	2
TA-40-11 (room 106)	5	2
TA-40-14	4	25
TA-40-41	5	36

6.3.5 Personnel and Explosive Load Limits TA-14

Building No.	Person Limits operators/casuals	Explosives (lbs)
TA-14-23 room 104	3	50

6.3.6 Detonators and Pellets

- A limit of 150 approved detonators (see Attachment 1, "Allowable Explosives") and 100 booster pellets may be kept in all charge preparation rooms for use in making up charges. **Note: This is 6 trays.**
- Detonators and pellets must not be stored in the same container.
  Each category must be stored in nonpropagating containers approved or supplied by DX-1. These limits do not include detonators or pellets incorporated in charges delivered to the preparation rooms from a source outside DX Division.
- Detonators, pellets, and explosives consumed in shots must be documented on the shot sheet so that HE inventory is always current.

6.4 Explosives Allowed in Charge Preparation Rooms

No explosive powders or primary explosives will be handled by DX-4 without prior approval or appropriate SOPs/SWPs.

All explosives or explosive-containing devices that have been approved by the ERC or listed in (ESA) WX-3: SOP 1.1.0, Tables 1 & 2 may be used at DX-4. See Attachment 1 for a list of Explosives routinely used at DX-4.

- Special allowable explosives that are specifically permitted in Attachment 1 under "Special Explosives Operations," may be kept and handled in the charge preparation rooms.

6.5 Compatible Materials

Compatibility rules must be observed when working with explosives. Substances incompatible with explosives can produce heat or a chemical reaction that leads to a more sensitive or less stable explosive. Only compatible materials can be used in contact with explosives. Group DX-2 approves all materials for compatibility.

6.5.1 Adhesives and Coatings

Only approved adhesives and coatings, listed in Attachments 2 and 3, may be allowed in contact with explosives. Care must be taken in cleaning explosives with solvents, since many explosives will dissolve in common solvents such as acetone.

6.5.2 Flammable solvents

Use of flammable solvents in an explosives area considerably increases the explosive hazard because of the greater ease-of-ignition of the solvent may lead to a fire involving explosives. Therefore, solvent use and evaporation shall be kept to a minimum. Solvent use will take place in well-ventilated areas, or with proper personal protective equipment. Prudent practice dictates storage of no more than one day's supply of solvents and other flammables in a preparation room.

6.6 Storage of Explosives in Preparation Rooms

Preparation areas are not normally used for the storage of explosives. However, prepared assemblies of explosive components and assemblies of explosives and inert materials may be left in preparation areas, provided this is necessary to avoid compromising the integrity of the assembly by moving it or storing it in a magazine. Only HE for the shots being assembled may be kept in the preparation room. Shots under construction or explosives otherwise in process may be kept in the preparation room.

6.6.1 Temporarily Storing Assembled Charges

- If charges are approved for storage in a Preparation room, either they must not interfere with other operations, or else operations will be suspended.
- Every effort should be made to limit the amount of explosives in the Preparation Room to the minimum necessary for the experiment or test being assembled.
- If charges stored in the charge preparation room significantly reduce the available floor space, the DX-4 Group Leader or responsible Firing Leader shall reduce the occupancy limit until the charges are removed. Such explosives should be moved to a magazine, if possible, before this constraint is needed.
- If an experiment is canceled, the charge for that experiment will be disposed of or will be moved to an appropriate storage magazine before a new operation is started.
- Explosive assemblies not scheduled for firing within a reasonable length of time should be moved to an appropriate storage location.

6.6.2 Emptied Containers

Before reusable high explosive storage containers can be returned for reuse, the containers shall be inspected, to be sure they are empty. The inspection requires the removal of all inner liners and packing materials to verify that all high explosives have been removed. An "empty" tag shall be affixed to the empty container after the inspection.

Empty containers should not be stored in preparation areas.

6.7 Safety Equipment (Personal Protective Equipment)

6.7.1 Safety Glasses or Goggles

Safety glasses or goggles (ANSI Z87.1) are to be worn in accordance with DX-4 SOP, "General Safety," except when eye protection must be removed for the use of optical and other inspection devices.

6.7.2 Gloves

Suitable gloves are recommended to be worn when working with solvents and adhesives, unless other means of preventing their contact with the skin are used. In cases where the gloves do not compromise the safety of the operation, surgeons gloves may be worn when handling small or precision pieces of explosive, primarily to keep the explosive free of skin oils, but also to protect the operator against skin rashes that may result from exposure to explosives.

In particular, propellants and materials containing nitroglycerine can have a physiological effect, and gloves should be worn when handling these materials.

6.7.3 Protective Clothing

- Flame-retardant or nonstatic clothing is not required for normal DX-4 operations.
- Personnel working with explosives should wear Laboratory-issued coveralls or laboratory coats, depending on the operation, to prevent contaminating personal apparel.
- Explosive-contaminated clothing shall not be removed from the Explosives Allowed Area except for cleaning or final disposal.
- If protective clothing has been contaminated, or if contamination is suspected, the clothing must be monitored for HE contamination, properly packaged, and delivered to ESA for cleaning.
- When working with DU, see SOP 2.14 DU Components.

6.8 Approved Electrical/Electronic Equipment

6.8.1 Explosion-proof (EP) outlets and equipment will be used in environments that have an explosive atmosphere.

6.8.2 Equipment using a 110 volt alternating current must be kept a minimum of one meter from exposed explosives, or else an SWP will be used. Appropriate measures shall be taken to prevent such equipment from any contact with explosives. An insulating barrier such as plexiglas between the 110V and the explosive allows closer proximity.

6.8.3 Tools producing sparks or high velocity chips or tools with any potential for producing fragments (such as grinding wheels and high speed drill motors) shall not be used around explosives.

6.8.4 Certain electrical equipment not rated NEC Class I or II is permitted for administratively controlled use within the Explosive Preparation Rooms. The equipment listed in Attachment 4 is approved as intrinsically safe when used under the restrictions noted. No electrical equipment may be used unless it is considered NEC Class I or II as modified by the DOE Explosives Safety Manual, or listed in Attachment 4.

6.8.5 Cellular phones and other RF Equipment

Handheld radios and mobile RF transmitters (e.g., cell phones) are generally allowed for use within the Explosives Firing Areas. However, in areas where low energy EEDs are stored or used in assemblies or test devices, special control must be exercised.

Likely restricted areas include:

- TA-22-34,
- TA-22-93,
- TA-22-Magazines
- TA-40-5, 6, and 7,
- TA-36-11,12.

6.8.5.1 Whenever low energy EEDs are present, it shall be the responsibility of the Firing Leader in the potentially restricted areas to inform the appropriate access control personnel that all RF transmitters in these areas are prohibited. This will be accomplished by informing access control personnel in the TA-22 (DX-1) Group Office, the TA-15-183 Access Control Office, or the TA-39-2 Administrative Office, who will then restrict visiting personnel from using RF transmitters. Further, operators will place signs on all routine entrances to these areas informing personnel to turn off all RF transmitting devices before entering these areas. The Firing Leader will assure that all personnel within the restricted area are informed of the prohibitions.

6.9 Spilled Explosives

Spilled explosives shall be cleaned up immediately, then disposed of per the DX Division Waste Management SOP if necessary.

6.10 Eating

Personnel shall not consume any food or drink item in any Preparation Room.

6.11 Operating Vehicles Near Charge Preparation Rooms

Do not drive private or government vehicles that do not have spark arrestors or catalytic converters closer than 25 ft. to any charge preparation building or a charge that is on a firing mound. Turn off the engine before opening any door to a charge preparation area.

Vehicles authorized to carry explosives will comply with all the requirements of the DOE Explosives Safety Manual.

6.12 Working Alone

DX-4 employees with current safety training and who are experienced in explosive operations may work alone under appropriate circumstances, such as assembly, measurement, gluing, inspection, and clamping of certain consolidated explosives and explosive devices.

6.12.1 This working alone procedure authorizes personnel to work alone in DX Division HE Operations. When working alone with HE, employees will use a procedure appropriate for the particular work area. These procedures require Access Control, Local Access Office, or a coworker to have the following information.

- Who is working alone,
- Where they are located,
- How long they will be working alone (with a completion time).

6.12.2 All operations shall be performed in accordance with existing SOPs/SWPs. Personnel shall be assigned in a manner such that each worker's presence is frequently monitored, for example, via radio, or by a physical check. New, special, or nonroutine operations will require a separate assessment and an SWP before being performed by a person working alone.

6.13 Lightning

All operations involving explosives in Preparation Rooms shall be suspended during electrical storms, as described in the DOE Explosive Safety Manual.

7.0 PROCEDURAL STEPS

7.1 Assembly Practices

7.1.1 Permitted Operations in Charge Preparation Rooms

- Gluing of plastic, metal, and other approved materials to explosives is allowed with approved adhesives listed in Attachment 2. Assembly may involve application of metal foils or pins to charges.

- Mechanical fixtures used to hold parts together during the gluing process must be approved by the DX-4 Group Leader or a designee. This approval process may include review by the ERC for novel applications.

- Inclusion of explosive parts in a close tolerance mechanical assembly is allowed, as long as there is no mechanical force brought to bear on the charge.

- Inspection and measurement of explosive pieces and assemblies is permitted, using rulers, local or commercially manufactured micrometers, dial indicators, cathetometers, chemical balances, microscopes, height gauges, and similar measuring equipment.

- Equipment such as microscopes or electronic balances, and approved meters may be used if the electrical wiring is protected from contamination with explosive dust.

- A portable low-voltage (<12-V) flashlight may be used for local illumination during assembly and measurement operations.

- Battery powered soldering pencils with momentary switches may be used, provided the HE is protected from hot solder or the hot iron.

- Working Comp C-4 or XTX by hand is allowed.

- Painting on or spraying on of coatings is allowed. Approved coatings are listed in Attachment 3.

- Cleaning inert portions of an assembly with alcohol or acetone is allowed.

- Cleaning explosives charges with water, alcohol, or a dry tissue is allowed. Acetone may be used if it doesn't dissolve explosive or binder.

- Detonators and boosters may be assembled to a charge in the Preparation Room or on the Firing Pad. It is good practice to attach detonators as late in an operation as possible.

- See Photo and Illumination SOP.

7.1.2 Cutting and Boring Operations

Cutting Primacord, Detasheet, and XTX-8003 with a razor blade or other sharp blade is allowed. Inspect the tool for cleanliness and sharpness before cutting. Cut the Detasheet on a plastic or rubber surface.
Detasheet may also be cut with a cork-boring tool. Use the cork-boring tool only for cutting Detasheet.

Bending or shaping Detasheet is allowed with the following restrictions:

- Curvature must be in one direction only.
- Bend or roll the detasheet to a radius of curvature not less than four times the sheet thickness, to prevent tearing.
- Grinding operations at TA-40-41 will be covered under a separate SOP/SWP.

7.1.3 Housekeeping

Prior to any HE operation, the operators must inspect the floor to ensure that it is free from debris such as coarse sand or larger particles. If the floor is dirty, it must be swept prior to beginning the explosive operation.
Similarly, the benchtops, flats, and other work areas are to be kept free of grit and particles.

7.1.4 Handling Explosives

Charges may be moved by hand within and between buildings in storage containers.

- One person can handle up to 25 kg.
- Two people can handle up to 50 kg.
- Good footing conditions must exist, with no snow, ice, or weeds on the pavement.

7.2 Unapproved Adhesives

To avoid mistakes, do not take unapproved glues into the charge preparation rooms, except for short times on occasions when they will be used. Store these adhesives outside the preparation rooms.

Glues not approved for use on explosives may be used to assemble nonexplosive parts of charge assemblies when

- the glue will not be in contact with explosives, and
- if possible, the gluing should be done elsewhere than the charge preparation room.

These glues must be cured before the assembly is combined with explosives parts.

If a detonator assembly must be sealed so that it can be immersed in water or other liquid, use GE Silicone Rubber RTV 162, 732, Barco Bond, Green Glue, urethane 7200, or Sylgard.

The above materials function with detonators. However, in general, if a liquid smells like vinegar, do not use it on a detonator; there is evidence that acetic acid and other organic vapors may desensitize the PETN in detonators which could negatively affect detonator performance.

Consult Group DX-1 for their recommendation about the suitability of any other glue, even those allowable for HE, for use in assembling detonators.

7.4 Allowable Mixtures with Nitromethane

Nitromethane may be mixed with acetone or toluene, B_4C particles, cabosil or diethylene triamine. Obtain approval from the Group Leader before using any other solvent.

7.5 Attaching Diagnostics to Charges

1. Attach metal foils or pins to charges with glue or tape.
2. Pins may be inserted in Primacord, Detasheet, or plastic explosive.
3. Attach "pin" circuits with clips or crimp connectors, or with a battery-powered soldering pencil with a momentary switch, and test the assembly with a battery-operated volt-ohmmeter certified for use in the charge preparation room by DX-1.

7.6 Applying Protective Coatings

Coat explosives when necessary to protect the surface, to reduce light, and for other purposes. Select coating fluid to be used in contact with explosives from the list in Attachment 3. If a coating fluid is not on the list, it must be approved by the DX-4 Group Leader before it is used.

7.7 Using Hand Tools

Tools producing high velocity chips or tools with any potential for producing fragments (such as grinding wheels and high speed drill motors) should not be used around explosives.

- Do not use tools that are designed to produce sparks, without an SWP.
- Maintain and use hand tools as needed.
- Do not use tools directly on the explosive, except as explicitly described under "cutting and boring" in this procedure.
- Measuring tools such as micrometers may be used with care.

7.8 Performing Continuity Checks

Test the detonator before mounting on the main charge.

- Use a continuity meter supplied or approved by DX-1 to check continuity of detonators.

7.9 Emergency Procedures

7.9.1 In all emergencies, call 911. In the event of an emergency or incident, notify DX-4 management as soon as possible. Follow the DX Division Operations Manual, Section 10.3 to report any incidents or accidents.

7.9.2 The Building/Site Emergency Plan will be followed. It covers what to do, depending on the circumstance.

7.9.3 If a spill occurs, the Building/Site Emergency Plan will be followed, then the Waste Management Coordinators shall be called. The DX Division Waste Handling and Management SOP shall be followed.

7.9.4 In the event of eye damage or suspected eye damage the injured person will be taken to the Occupational Medicine Group (ESH-2) for treatment.

7.9.5 Any person receiving an electrical shock must report to the Occupational Medicine Group (ESH-2) for evaluation and/or treatment.

7.10 Fires

In the event of fire involving or imminently threatening explosives,

CLEAR THE AREA AND REPORT THE FIRE.
DO NOT ATTEMPT TO FIGHT ANY FIRE INVOLVING OR THREATENING EXPLOSIVES IN ANY DX DIVISION EXPLOSIVE AREA.

7.10.1 There shall be no smoking at DX-4 Preparation Rooms. No matches, lighters, or other fire, flame, or spark-producing devices shall be taken into an Explosive Allowed Area, except with written authorization (SWP).

8.0 REQUIRED RECORDS

- Site Record Log Book
- Hazardous Material Transfer form.
- Lists of Allowed Explosives and Adhesives

9.0 REFERENCES

- DX-4 SOP General Safety
- DX-4 SOP, "HE Storage"
- SOP DX-4-1.0, "General Access Control"
- DX Division SOP, " Disposal of Explosive Waste and Explosive Contaminated Waste"
- DX Division Training and Qualifications Manual
- DX Division Operations Manual
- DX Division SOP, "Shipping, Receiving, and Transporting Explosives"
- DOE *Explosives Safety Manual*
- LANL *Environment, Safety and Health Manual*, AR 6-6, "Explosives" and AR 12-1, "Personnel Protective Equipment, and AR 10-3, "Chemical, Hazardous, and Mixed Waste DX-11 SOP: 15-11-4.5, "Loading and Reloading Ammunition"

10.0 ATTACHMENTS

Attachment 1.	List of Explosives routinely used at DX Division Firing Areas
Attachment 2.	List of Approved Adhesives.
Attachment 3.	List of Approved Coating Fluids.
Attachment 4.	Allowed Electrical Tools.

Attachment 1

List of Explosives routinely used at DX Division Firing Areas

NORMAL EXPLOSIVES

This list contains the names and identification numbers of all explosives and detonators approved for normal explosives operations. Only explosives on this list may be received or handled by Group DX-4, unless a separate SWP or SOP exists covering the operations, or a request for limited tests is approved.

Primary explosives - Explosives with a sensitivity greater than PETN (for example, lead azide, lead styphnate or mercury fulminate) that are not used by DX-4 except with specially approved procedures.

SINGLE-COMPONENT EXPLOSIVES

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
AN	130LN	Ammonium nitrate	20 years
DATB	1201	diaminotrinitrobenzene	20 years
DINGU		Dinitroglycouril	
DINA		Di(nitroethyl) nitramine, dioxyethyl dinitrate	20 years
EDNA	1101	ethylenedinitramine, Halite	20 years
HMX	03NN	cyclotetramethylenetetranitramine, Octogen	20 years
LAX-112			
NM		Nitromethane	10 years in 55 gal drum
NQ	07NN	Nitroguanidine, Picrite	20 years
NTO		1.2.4-nitro-tiazole-5-one	
PETN	06NN	pentaerythritoltetranitrate	20 years
Picric Acid		1,3,5-trinitrophenol note: Picric acid forms impact-sensitive compounds with metal ions.	2 years
RDX	02NN	cyclo-1,3,5-trimethylene-2,4,6-trinitramine; Hexogen, Cyclonite	20 years
TATB	1701	1,3,5-triamino-2,4,6-trinitrobenzene	20 years
Tetryl*	04NN	2,4,5-trinitrophenylmethylnitramine	20 years
HNS	3001	Hexanitrostilbene	20 years
TNT	010N	2,4,6-trinitrotoluene; Trotyl	20 years

* Tetryl has greater toxicity and greater sensitivity to electric spark than the other permitted explosives

LIQUID EXPLOSIVES

Explosive	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
FEFO		1,1'-[methylene bis(oxy)]bis[2-fluoro-2,2-dinitroethane]	90 days
Nitromethane		NM, see also under single-component explosives	10 years in 55 gal drum

MIXED EXPLOSIVES INCLUDING CAST AND PRESSED FORMULATIONS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev. Period
ANFO		Ammonium nitrate/fuel oil	90 days
Boracitols		60 wt% boric acid/40 wt% TNT	20 years
Baratol	76NN	76 wt% barium nitrate/24 wt% TNT	20 years
Calcitol		40 wt% TNT/55 60 wt% $CaCO_3$/0 2 wt% talc/1 2 wt%, microballoons, X-0533	90 days

Plastic Bonded Explosives - Formed from one or more of the explosive compounds listed individually in "Single-component Explosives," above, mixed with binders and, in some cases, nonexplosive ingredients. Production forms of plastic bonded explosives are identified in numbered series denoted by the letter "PBX-" (originated by Los Alamos); "LX-" (originated by Lawrence Livermore); "EDC-" (originated by the United Kingdom); and "PBXN-" (originated by the US Navy). Also permitted are experimental plastic bonded formulations originated at Los Alamos and identified by the prefix "X-" and a four-digit number.

MIXED EXPLOSIVES INCLUDING CAST AND PRESSED FORMULATIONS, Continued

CH-6		97.5 wt% RDX/1.5 wt% calcium stearate/0.5 wt% polyisobutylene/0.5 wt% graphite	20 years
Comp. A			
Comp. A-2			
Comp. A-3	9085	9085, 91 wt% RDX/9 wt% beeswax	20 years
Comp. A-4		97 wt% RDX/3 wt% beeswax	20 years
Comp. A-5		98.5 wt% RDX/1.5 wt% beeswax	20 years
Comp. B	60NN	64 wt% RDX/36 wt% TNT, Comp B, Hexolite, Hexotol	20 years
Comp. B-3	60NN	60 wt% RDX/40 wt% TNT	20 years
Comp. C-3	9080	9080, 88 wt% RDX/12 wt% wax	20 years
Comp. C-4	9081	9081, 91 wt% RDX/2.1 wt% polyisobutylene/ 1.6 wt% motor oil/5.3 wt% di(2-ethylhexyl) sebacate	20 years
Cyclotol 75/25	750N	75 wt% RDX/25 wt% TNT	20 years
Cyclotol 70/30	700N	70 wt% RDX/30 wt% TNT	20 years
Detasheet C	6300	63 wt% PETN/8 wt% NC/29 wt% elastomeric binder	10 years
Detasheet D	6301	75 wt% PETN/25 wt% elastomeric binder NOTE: THIS MATERIAL IS USUALLY RED, BUT IT IS AN EXPLOSIVE, NOT AN INERT	10 years
EDC-8		76.0 wt% PETN/24.0 wt% RTV Silicone	20 years
EDC-28		94wt% RDX/6 wt% FPC 461	20 years
EDC-32		85wt% HMX/15 wt% Viton A	20 years
EDC-37			20 years
EDC-38			20 years
HBX-1		40 wt% RDX/38 wt% TNT/17 wt% Al/4.5 wt% wax/0.5 wt% $CaCl_2$	20 years
LX-04	LX04	85.5 wt% HMX/15.0 wt% Viton	20 years
LX-07	LX07	90 wt% HMX/10 wt% Viton	20 years
LX-10	LX10	95.0 wt% HMX/5.0 wt% Viton A	20 years
LX-14	LX14	95.5 wt% HMX/4.5 wt% Estane 5702-F1 (X-0282)	20 years
MDF		Mild Detonating Fuse	20 years

Nonel		RDX lined metal tubing	20 years
Octogen		94.5 wt% HMX/4.5 wt% wax/1 wt% graphite	20 years
Octol	740N	75 wt% HMX/25 wt% TNT	20 years
PBX 9001	9001	90 wt% RDX/8.5 wt% polystyrene (PS)/ 1.5 wt% dioctyl phthalate (DOP)	20 years
PBX 9007	9007	90 wt% RDX/9.1 wt% polystyrene (PS)/ 0.5 wt% dioctyl phthalate /0.4 wt % resin	20 years
PBX 9010	9010	90 wt% RDX/10 wt% Kel-F 3700	20 years
PBX 9011	9011	90 wt% HMX/10 wt% Estane-5703	20 years
PBX 9205	9205	92 wt% RDX/6 wt% polystyrene (PS)/ 2 wt% dioctyl phthalate (DOP)	20 years
PBX 9206	9206	92 wt% HMX/8 wt% Kel-F elastomer	20 years
PBX 9404	9404	94 wt% HMX/3 wt% NC/3 wt% tris(b-chloroethyl) phosphate (CEF) note: PBX-9404 is unusually sensitive to certain types of impact, in partucular, skidding.	1st period-20 years, 10 years thereafter
PBX 9401	9401	94.2 wt% RDX, 3.6 wt% polystyrene, 2.2 wt% trioctyl phosphate	
PBX 9405	9405	93.7 wt% HMX, 3.15 wt% nitrocelulose, 3.15 wt% tricloroethyl phosphate	20 years
PBX 9407	9407	94 wt% RDX/6 wt% Exon-461	20 years
PBX 9501	9501	95 wt% HMX/2.5 wt% Estane/2.5 wt% BDNPA or BDNPF, X-0242	20 years
PBX 9502	9502	95 wt% TATB/5 wt% Kel-F 800, X-0290	20 years
PBX 9503	9503	80 wt% TATB, superfine/15 wt% HMX/5 wt% Kel-F, X-0351	20 years
PBXN-5		See LX-10	20 years
PBXN-110		88 wt% HMX/5.4 wt% polybutadiene/5 wt% isodecyl pelargonate	20 years
PBXW-113		See PBX N110	
Primacord		Assorted PETN & RDX loaded commercial detonating fuse	20 years
Pentolite	5001	50 wt% PETN/50 wt% TNT	20 years
Tritonal		80 wt% TNT/20 wt% aluminum powder	20 years
X-0208	X-0208	See XTX-8004	20 years
X-0233	X-0233	5-40 wt% HMX; 40-95 wt% tungsten, 0-10 wt% polystyrene, 0-5 wt% plasticizer	90 days
X-0242		See PBX 9501	20 years
X-0282	X-0282	See LX-14	20 years
X-0290	X-0290	See PBX 9502	20 years

X-0309	X-0309	75% TNT, 19% aluminum powder, 5% D-2 wax, 1% acetylene black (carbon)	90 days
X-0351		See PBX 9503	20 years
X-0407	X-0407	69.8 wt% TATB, 25.0 wt% PETN, 0.2 wt% dye, 5 wt% kel F800	90 days
X-0533	X-0533	See Calcitol	90 days
X-0534	X-0534	50 wt% TNT/16 24 wt% $CaCO_3$/25 33 wt% talc/1 2 wt% microballoons	90 days
XTX-8003		80 wt% PETN/20 wt% Sylgard 182	20 years
XTX-8004		80 wt% RDX/20 wt% Sylgard 182, formerly X-0208	20 years

PROPELLANTS

Explosives	ESA-2 Mat. Code	Other Names, Composition, or Reference	Storage Rev Period
Black powder		Standard commercial and military grades only	20 years if unopened, 2 years if opened
Benite		Black powder based mixture	2 years
Commer-cial sporting		Any commercially available smokeless gun propellant for sport use is approved	20 years if unopened, 2 years if opened
HARP-1,-2		HARP propellants are Al/AP/HMX composites	2 years
HELP-1, -2		HELP propellants are NC/NG/HMX composites	2 years
Smokeless Powder Single, Double, or Triple Base		Standard military grades. Single or multi-perforated grains of colloided NC. Stabilizers, plasticizers, inorganic nitrates, and other modifying agents may also be present. Military research explosives are specifically not included.	2 years
UTP 25540		HMX based High Energy Propellant	2 years

DETONATORS

The following high-energy detonators have been approved for Group DX-4 use in test devices. All listed detonators have a storage review period of 20 years.

1E23	ER-213	EX-12	SE-1
1E26	ER-235	EX-12B	SE-1/31
1E26B	ER-312		
1E27	ER-312B	MC1991	SC-101
1E29	ER-344	MC2320	
1E30	ER-347	MC2427	
1E31	ER-352		
1E33	ER-353	MK13C	
1E34	ER-370	MK20	
1E36	ER-349	MK22A	
1E38	ER-350		
1E38 T.F.	ER-351	RL1	
	ER-371	RL2	
	ER-377		
	ER-379	RP-1	
	ER-380	RP1/31	
	ER-383	RP-2	
	ER-396A	RP-80	
	ER-396B	RP-83	
	ER-400	RP-84	
	ER-402	RP-87	
	ER-403		

MUNITIONS

Military munitions are allowed if no further assembly or disassembly operations are involved. An adequate description should be in the DX-4 file. Internal devices that contain primary explosive are allowed if they are out-of-line and ar not used as the initial initiation point. The initiator must remain in a safe state until the first ignition source is activated following standard operating procedures. Any configuration where the primary explosive unit is external or is to be used as the first initiation or ignition source becomes a special operation requiring a separate SOP or SWP.

Some of the military munitions are listed as rejects or defective lots because they do not meet either physical specifications or performance testing specifications. There are no safety issues related to their rejection. Any arriving munitions marked as rejects will be treated as Storage Compatibility Group L until the reason for rejection is known.

SPECIAL EXPLOSIVES

The use of these explosives is limited to the provisions of the indicated SOPs.

Explosive	Pertinent SOP References	Storage Rev. Period
Liquid Gun Propellant LGP 1846	DX-11 SOP: 15-11-4.20, LGP 1846, TA-36-3	2 years
3E-1 Detonator	3E-1 SWP	20 years

COMPOUNDS FOUND in TA-16 SOP 1.1.0, "Established Explosives at TA-16," but not listed in any DX Division list.

Al-ANFO

BDNPA

BDNPF

BTX (5,7-dinitro-1-picrylbenzotriazole) (transportation only)

DNPA (2,2-dinitropropyl acrylate polymer)

DNT

HBX-1

Methane/ Oxygen mixtures

Nitrocellulose (NC)

PYX (2,6-Bis(picrylkamino0-3,5-dinitropyridine

STRATABLAST C (storage and transportation only)

TAGN (triamino guanadine nitrate)

TAL-1005E (storage and transportation only)

TNS (Trinitrostilbene)

TNT/NC

TPM (tripicryl melamine)

Attachment 2

Adhesives, glues, and coatings routinely used at DX Division Firing Areas.

- Methylmethacrylate/solvent glues (Duco, Testor's model cement, other proprietary materials of equivalent composition).
- 3M Industrial Adhesive-226.
- CTA-2 linoleum cement for Detasheet only.
- Elvanol.
- CPR-1009-78 adhesive.
- Silastic TRV-140, -731, -732, -892, -3145
- Eastman 910, Perma Bond 910 adhesive, Loctite 495 adhesive, and other cyanoacrylate ester adhesives .
- 3M Aerosol spray adhesive.
- Aralhex.
- GE Silicone Rubber RTV 162.
- Polad [10 wt% Polacure-740M diamine (Polaroid Corp.)/38 wt% Adiprene 5333/52 wt% acetone].
- Polyurethane 7200, with sets A and B.

When necessary, the following chemicals and gases may be used for light intensification or quenching.

Aluminum Fluorosilicate **(This is a poison; wash hands after use.)**
Aluminum Oxide
Butane
Krylon Spray Paint
Magnesium Oxide
PETN paint

Approved Glues and Adhesives

- An epoxy -polyamide adhesive know as "Green Glue" and formulated from Epon 828 and Versamid 140 is approved for use in detonator and HE assemblies. This adhesive is covered under Mound Facility's Specification 1-9600.

- Cyanoacrylate adhesives such as Eastman 910 may not be used in direct contract with PETN.
- Devcon 5-minute epoxy is approved for permitted explosives, except TNT and explosive compositions containing TNT, and is permitted for assemblies which will hold liquid explosives after the adhesive is cured.
- Barco Bond 165 and 185 - The curing reaction for this material is exothermic: therefore, the thickness of the adhesive layers must not exceed 1.5mm (1/16 in.).
- Sylgard 182, 184, and 186
- DC 93-119
- GE 630
- CPR-1009-78 + Component "T"

Adhesive	**Additive or Catalyst**	**Remarks**
Aerobond 2017	Trimethoxy-boroxine	Compatible with HE. Exothermic reaction. Don't make more than 50 g at a time.
VEEP 1579 VEEP 1579T	Versamid 140 DMP-30	Not compatible with all HE. May be used on PBX 9502, TATB, an mixtures of TATB and inert materials.
Torr Seal	Polyamide	Can be used on HE as described in report #250. Ideal for vacuum applications, sealing leaks.
Polamine 1000		Compatible with HE. Slight foaming cured polyurethanes from moisture. Do not breathe vapors.

Attachment 3

LIST OF APPROVED COATING FLUIDS

Coating fluids used in contact with explosives must be selected from the following list. If a coating fluid is not on this list, it must be approved by the Group Leader before it is used.

Microballoons in silicone, hydrocarbon grease, or in polyvinyl alcohol and water.

Apiezon wax.

Mineral oil.

Petroleum greases and oils.

Glazing compound, modeling clay, and putty.

Krylon or other methylmethacrylate spray.

Isopropyl alcohol or ethyl alcohol.

Silicone grease.

Water.

Acetone.

Aluminized Mylar.

When necessary, the following chemicals and gases may be used for light intensification or quenching.

Aluminum Fluorosilicate **(This is a poison; wash hands after use).**
Aluminum Oxide
Butane
Krylon Spray Paint
Magnesium Oxide
PETN paint

Attachment 4

APPROVED ELECTRICAL EQUIPMENT IN PREPARATION ROOMS

	Restrictions
Bendix height gauge indicator model - BXT-1	(2)
Chicago multi tester	(6)
Fluke Multimeter, Model 8012A/AD	(3)
Fowler 12 calipers	
Fowler depth gauge	
Hewlett Package calculator, model 55	
Laser HE-NE-AERO-Tech. model LSR2P	
Ledu Corp., portable lamp. model 060333	(2)
Mettler Balance, model PE360	(1)
Mettler Scale, model PM-400	(1)
Minolta 35mm camera, model X700	(2)
Minolta Electro Flash, model 280 PX	(2)
Mitutoyo height gauge, model 519-106	(2)
Mitutoyo height gauge, model 519-302	(2)
Mitutoyo height gauge readout, model 122	(2)
Mitutoyo height gauge readout, model 8943G	(2)
Mitutoyo indicator, model ID-ISOE	(2)
Nikon camera, model F	(2)
Ohaus Balance	(1)
Ohaus Scale, model T600S	(1)
Polaroid camera, model Spectra System	(2)
Polaroid camera, model SX70	(2)
Sartorius Scale, model P6	(1)
Sartorius Scale, model P600	(1)
Sunpack Autoflash, model 30DX	(2)
Texas Instruments TI 55III calculator	
Triplet VOM Meter, model 630	(6)
Unitron inverted microscope with light source, model 7530	(2)
WAHL Soldering Station, model 7500	(2)
Weller Soldering Station, model WTCPN	(2)

^^

(1) Balances will be inspected, cleaned, and calibrated biannually.
(2) Not for use at work stations with loose powder.
(3) Approved for use as a Detonator Circuit Ohmmeter (DCO).
(4) Locate illuminator in ventilated enclosure.
(5) For use in a work station with no HE present.
(6) Not approved for DCO use.

STANDARD OPERATING PROCEDURE

FOR

FIRING OPERATIONS

SOP M-8-5

Because of the transition from M-4 and M-8 to DX-11, this SOP has been reviewed by DX-11 and ESH-5 personnel and is issued without changes for operations at TA-36.

Next Review Date: August 1995

Approved by: C. M. Mon Date: 9-27-94
DX-11

Approved by: ______ Date: 9/27/94
DX-DO

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

SPECIAL WORK PERMIT FOR POTENTIALLY HAZARDOUS ACTIVITIES

Requested by	Organization	Issue Date	Expiration Date
Bruce E. Takala	DX-11	Sept. 23, 1994	Sept 1, 1995

Location of Work (Tech Area, Building, Room Number)	SWP I.D. Number
TA-36 – all firing sites	SWP-DX-11-94-21

Work to be Performed
Handling explosives at firing sites.

Extend operations of SOP M-8-5, "Firing Operations," to Sept. 1, 1995

Identified Hazards
Handling explosives during firing operations.

PERSONNEL ASSIGNED

Name	Duties
See attached distribution list	
Name	Duties
Name	Duties

SPECIAL CONTROLS

Safety Measures, Precautions, Personal Protective Equipment, Procedures, etc.

See attached SOP.

APPROVED BY

		Organization	Date
Group Leader Allan B. Anderson, Group Leader	for R. M. Mx[illegible] DGL	DX-11	9/26/94
Safety Officer Bruce E. Takala, Safety Officer	Bruce Takala	DX-11	9/27/94
Supervisor		DX-11	
Others Diane Griechen, ES&H Officer	Diane Griechen	DX-DO	9/27/94
Roger Goldie, Safety Engineer	Roger Goldie	ESH-5	9/27/94

STANDARD OPERATING PROCEDURE

FOR

FIRING OPERATIONS

Prepared by: John B. Ramsay
J. B. Ramsay
Date: Dec 2, 1992

Approved (M-8): J W Straight
J. W. Straight
Date: 12/2/92

Approved (M-DO):
T. R. Neal
Date: 12/9/92
dg 12/10/92

Approved (HS-5): R H Goldie
R. H. Goldie
Date: 12/21/92

Implementation: C. M. Montoya
C. M. Montoya, M-8 ES&H Chairman
Date: 2/17/93

This SOP has been approved by M-8 and M-DO. While we await final approval from groups in HS or other divisions, we are using the SOP as a completely legitimate instrument. If more than 30 days has elapsed without action by reviewing groups outside M Division, the SOP will be regarded by the M-8 Group Office as having the full force of complete and unqualified endorsement.

1.0 INTRODUCTION

None.

2.0 PURPOSE

Some SOPs involve specific operations, but this one describes the basic procedures and protocols by which a safe environment is ensured for all personnel at TA-36 and TA-14 (Q-Site West) during preliminary preparations, circuit testing, clearance, firing operations, and misfire procedures.

3.0 SCOPE

This SOP presents the procedure for conducting test-firing operations involving explosives at TA-36 (Kappa Site) and TA-14 (Q-Site West). It covers these operations at the six firing sites, Bunkers TA-36-3 (Eenie Site), TA-36-6 (Meenie Site), TA-36-8 (Minie Site), TA-36-12 (Lower Slobbovia), TA-36-107 (IJ Point), TA-14-34 (Q-Site), and at their associated firing mounds. Some unique TA-14 (Q-Site West) operations are covered in a separate SOP, M-8-80, and fragment shots that require clearance along Ridge Road are described in SOP M-8-87. Test-firing operations involving the use of a rocket on the sled track at TA-36-12 are covered in SOP M-8-92.

4.0 DEFINITIONS

4.1 Radio-equipped vehicle: A government vehicle equipped with a two-way radio tuned to the designated M-8 frequency.

4.2 Hand held: A two-way hand held radio.

4.3 Knowledgeable Visitor: A few Non-M-8 LANL employees have work duties that require frequent visits within the M-8 firing areas, and they are knowledgeable of M-8 safety procedures. Only the Group Leader or the Deputy Group Leader may designate a Knowledgeable Visitor. After such designation, this person need not log in or out with the M-8 Group Office to enter the firing areas and may escort other visitors, just as M-8 personnel may.

5.0 FIRING-SITE SAFETY FEATURES AND PERSONNEL RESPONSIBILITIES

The following features cover the operations at all TA-36 firing sites.

5.1 Firing-Area Gate

Access is controlled to the M-8 firing sites by means of a radio-controlled gate located 100 m west of the Group Office Building (TA-36-80).

5.2 Group Office Control of Access Through Firing-Area Gate

M-8 personnel and knowledgeable visitors gain access to the firing areas by using portable actuators to lift the gate barrier. All other individuals must clear through the Group Office before they will be allowed access to the firing area. Group Office personnel instruct visitors on the site hazards, have them read the Visitor Packet, and enter their names in a log. Group office personnel will contact the sites where the visitor wants to go to ensure that conditions are clear. Visitors contact the Group Office by speaker phones at the approach to the gate, and the Group Office raises the gate to allow visitors' vehicles to enter. As each visitor is leaving, he/she will again contact the Group Office at the gate, and the time of departure will be recorded in the log. Non-M-8 personnel accompanied at all times by an M-8 employee or a knowledgeable visitor need not clear through the Group Office.

5.3 Firing-Control Keys

Each firing circuit is locked, and only authorized M-8 Firing-Site Supervisors have keys to these locks attached to their exchange badges. Spare keys are locked in the Group Office key box. The Group Leader, Deputy Group Leader, or Acting Group Leader can authorize a site assistant to use a key temporarily when the site supervisor is absent. Each unit can be operated only with the key.

5.4 Firing-Circuit Test Mode

Before actual firing, but frequently after a charge has been assembled on the firing mound, personnel may want to test various aspects of the firing-control circuits; this may include charging and triggering the CDU. A by-pass system is installed at each firing site except Q-Site. These by-passes, actuated by turning a firing-circuit lock switch to the "Test Mode," permit the CDUs to be charged and triggered without the audible and visual warnings and without closing the interlock systems. Each by-pass system is interlocked with a cable trap door, through which the detonator cables must pass to be connected to the CDU. Thus, connecting a detonator cable to the CDU disables the "Test Mode" by-pass function, thereby preventing the firing of a shot when the warning system is not operating.

5.4.1 Warning signals should generally not be sounded on the horn or siren when any of the firing equipment is being maintained, adjusted, or operated with any intention other than that of indicating that a hazard exists, except that the warning signals may be tested to determine whether they are in operating condition. If a "nonhazard" test involves using the warning signals, this condition should first be announced over the radio.

5.4.2 Various components of the firing-control circuit are modified and improved at infrequent intervals. However, the design logic of the firing circuit shall always include a redundant system (two or more logic operations in series), which inhibits the connection of detonator firing cables or the high-voltage supply cable to the CDU or other firing system during the testing and maintenance phase.

5.4.3 Category II CDUs will follow a different procedure than the one described above. Testing will never be conducted on the mound while explosives are present and never conducted if the Category II CDU is connected to the detonator. Should testing of the firing circuit be required on the firing mound while explosives are present or while the Category II CDU is connected to the detonator, a special work permit to describe the procedure will be required, and permission shall be granted only by the Group Leader.

6.0 PRECAUTIONS AND LIMITATIONS

6.1 Warning Lights

Flashing red lights are located at the entrance to each firing site except IJ Point and Q-Site. They operate automatically when the firing circuit is unlocked. The firing control system indicates that the light and horn circuits have been activated. Routine clearance procedure at IJ Point requires that the access road be blocked by a manned vehicle during firing operations; therefore, the alternate procedure does not compromise safe operations. The roadblock system at Q-Site is described in SOP M-8-80.

6.2 Warning Horns

A horn sounds automatically when the firing circuit is unlocked. The horn is loud enough to be heard anywhere within the firing area. Hearing protection should be worn by any person outside the bunker and near the horn because the noise level is above the recommended short-term exposure limit.

Q-Site has only a siren, as described in SOP M-8-80.

6.3 Warning Signs

A warning sign near the firing mound reads:

DANGER

EXPLOSIVES

Return to lights if horn or siren is sounding.

A warning sign is used for blocking the access roads during a clearance procedure and reads:

DANGER

KEEP OUT

High-Explosive Operations in Progress

6.4 Radio Communication During Tests

There is free-channel radio communication among all firing bunkers, the charge preparation rooms, vehicles used for clearance operations, the Group Office, and several offices of M-8 group members whose expertise is often needed during shot operations. During the time that the firing circuit is unlocked, the radio shall be reserved solely for communication concerning the shot being fired and emergencies.

6.5 Telephone Communication During Tests

During the time that the firing circuit is unlocked, the telephone line to the site shall be reserved solely for calls concerning the shot being fired.

6.6 Firing-System Interlocks

The firing-system interlock prevents the connection of detonator cable to the 2500-V CDU, low-voltage (propellant) firing systems, or the high-voltage supply to the short-firing-cable CDU while electronic maintenance and tests are being performed.

Either the detonator cable or the high-voltage supply must be connected manually from within the bunker.

6.6.1 The normal (2500-V) firing units and low-voltage (propellant) firing systems are located inside the firing bunker. The detonator cables are disconnected from the firing system after each shot and are not reconnected for another shot until all personnel are inside shelter, as specified in Secs. 7.2.1 and 7.2.2.

6.6.2 For those shots in which the firing unit must be located adjacent to the shot assembly, the high-voltage power supply shall be located within the firing bunker and the high-voltage supply cable shall be disconnected from the firing unit within the building and not reconnected until everyone is under shelter, as specified in Secs. 7.2.1 and 7.2.2.

6.6.3 The firing-bunker door is interlocked with the firing circuit and, except as provided in SOP M-8-14 (Special Firing Procedure), it must remain secured throughout the firing sequence.

Note: For a full discussion of the operation of the firing units, see Attachment A.

6.7 Sequence Timer for Warnings and Circuit Charging

The timing of warnings and firing-circuit charging is controlled by the fire control system. Four minutes (during which the horn is sounding) are provided as a back-up clearance prompt. A 30-second siren warning is sounded, followed by a 30-second period without the siren sounding. After the siren sounds for 45 seconds, the selected firing unit can be fired. The siren continues to sound during this period. See Sec. 7.5 for the shutdown procedure of the siren.

6.8 Arm Switch

A spring-loaded "Arm Switch" controls the charging of the CDU or arming of the firing system. It enables the high-voltage power supply that is attached to the capacitor bank in the CDU. Pushing the "Arm Switch" disconnects a shunt across the capacitor bank and connects the bank to the high-voltage supply. The high-voltage power supply is interlocked so that pushing the arm switch enables output from the supply. CDUs without this redundancy feature must be evaluated by the M-8 instrumentation section and the M-8 safety committee, and then approved by the Group Leader. The "Arm Switch" also operates a relay enabling the low- voltage firing systems. These arming relays are energized by the operator actuating the "Arm Switch," as the final event in the timed sequence.

6.9 Camera Room Door

The door to the camera room will be closed whenever the rotating mirror in the smear camera is in operation. No one is permitted in the camera room when the rotating mirror is in operation.

7.0 PROCEDURAL STEPS

7.1 Preliminary Preparations

7.1.1 If, in the opinion of the Firing-Site Supervisor, there is a probability that a fire will be started as a result of a planned shot, the Firing-Site Supervisor will contact the Group Office 24 hours in advance of the scheduled shot time. The Group Office will notify the M-Division Office, which will contact the Fire Department. On the actual shot day, a one-hour warning of the firing time will be called directly to the Fire Department by the Firing-Site Supervisor. If an earlier firing time is desired, the Firing-Site Supervisor must contact the M-Division Office, and the Division Office will contact the Fire Department to reschedule, if possible. The Fire Department must be rescheduled if the prearranged time is delayed by more then 45 minutes. *(Note: communications within one hour of the scheduled shot time are made directly between the Site Supervisor and the Fire Department; otherwise, the M-Division Office should make the contact).* When reporting standby requirements, the Firing-Site Supervisor should give the shot a fire hazard category —low, medium, or high. The Site Supervisor may instruct another individual to handle the communications with the Division Office or Fire Department. The Fire Department will decide the number of tankers to be assigned to the shot. Special consideration should be given to shots involving uranium, copper, or tantalum. During the firing procedure, Fire Department personnel shall remain outside the area cleared for the firing operation until they are cleared for entry.

7.1.2 The Group Office should be notified, preferably 24 hours in advance, if an exceptionally large charge (100 kg or more) is to be fired. The Group Office will notify the M-Division Office.

7.1.3 If the fragment range is expected to include areas under the control of other groups (M-4 or M-6), the involved group shall be contacted through the M-8 Group Office for approval at least 24 hours in advance. Attachment C to this SOP discusses the evaluation of fragment hazards. Large shots at U Point with fragments that could affect M-4 operations are addressed in SOP M-8-87.

7.2 Clearance Procedure

All or any combination of sites (one to six sites) may fire under the same clearance operation if the site supervisors determine that no unusual hazards will be created by more than one firing operation under a single clearance.

Under the conditions stated in Sec. 7.2.2, people who are not knowledgeable about M-8 firing procedures may be within the anticipated hazard area. Therefore, it is imperative that the hazard zone be carefully cleared before any potentially hazardous operation is initiated. Only M-8 personnel or people accompanied by an M-8 employee will be allowed to remain within the hazard zone in a safe place. Persons remaining within the hazard zone must be in the firing bunker and not in either a day magazine or a charge preparation room. General maps of the firing sites are presented in Attachment B of this SOP. Each firing site has a map of its immediate area with a scale of
1 in. = 400 ft.

In each case described below, roadblocks will be established by parking a radio-equipped vehicle in the center of the access road, with an individual in radio contact with the firing bunker. The emergency warning lights on the vehicle will be operated throughout the clearance operation. If anyone passes a blockade and enters a hazard zone, the helper manning the roadblock shall immediately notify the Firing-Site Supervisor to "STOP" the firing sequence. The employee manning the roadblock shall remain at his station and shall not attempt to chase the person or persons who have passed the roadblock. The Firing-Site Supervisor shall immediately discontinue the firing sequence and confirm receipt of the message by stating:

"The firing sequence has been stopped at Bunker __."

The Firing-Site Supervisor should then take steps to clear the area again before restarting the firing sequence. Depending on the real extent of the hazard zone, as determined by the Firing-Site Supervisor, one of the following two levels of clearance will be used.

7.2.1 If the charge is bare [surrounded only by a low-density material such as wood, foam, sand, or cardboard, or is covered only by very thin, low-density metal (2-mm aluminum)] and if the Site Supervisor conducting the firing operation determines that the hazard zone is within the boundaries of the particular site, only that firing site need be cleared. A Firing-Site Leader may decide to clear to a larger hazard zone because of atmospheric conditions, because of a larger mass or new energetic compound, etc. This is accomplished by a helper who searches the site in a radio-equipped vehicle and proceeds to a safe position on the site entrance road. The vehicle should be parked, or a sign placed, to physically block vehicular access to the firing mound. The helper doing the clearing will then notify the Site Supervisor by radio that the firing area is clear for firing. The helper shall use the following format for this radio transmission:

"Calling (Name of Site Supervisor) at Bunker (No.) from (Name of helper); the firing area has been cleared to (Location)."

The Site Supervisor will then confirm the transmission as follows:

"This is (Name of Site Supervisor) at Bunker (No.), confirming roadblock at (Location)."

The manned roadblock will remain in place until the Site Supervisor notifies the helper that a safe condition exists.

7.2.2 When the hazard zone extends beyond the boundaries of the site at which the shot is to be fired, the following clearance procedure will be used.

The Firing-Site Supervisor will call the Group Office and obtain the number and location of visitors in the firing areas of TA-36 (Kappa Site). The Site Supervisor may then begin the clearance procedure, ensuring that all visitors have been cleared from the hazard zone or moved to a safe location under the aegis of an M-8 employee. Employees and visitors remaining during a shot must stay in the firing chambers, not in a day magazine or a charge preparation room.

Because of the geographic differences of the firing sites, four clearance procedures will be outlined.

- Bunker 12 (Lower Slobbovia)

  The Site Assistant will clear the firing site in a radio-equipped vehicle and proceed to a safe position on the site entrance road. If the hazard zone extends beyond the Main Magazine area (Bldgs. TA-36-9, -10, and -83), the fragment-area warning sign must be placed in the center of the site entrance road while the Main Magazine area is being cleared. After the hazard zone has been cleared, the helper will park the vehicle to block the road and notify the Site Supervisor by radio (using the format specified previously) that the Lower Slobbovia area is clear for firing. The Site Assistant will remain at his vehicle until he is notified by the Site Supervisor that a safe condition exists.

  If it is necessary to fire a shot for which the hazard zone extends 500 m (1600 ft) north-northeast toward Pajarito Road, a special SWP will be required.

- Bunker 3 (Eenie); Bunker 6 (Meenie); and Bunker 8 (Minie)

  Two radio-equipped vehicles will be required. The driver of one vehicle will proceed from Minie Site and clear the Minie-Site area. While Minie Site is being cleared, the driver of the second vehicle will clear Meenie-Site area. After Meenie Site and Minie Site have been cleared, the vehicles will meet at the Potrillo Drive intersection. The drivers will then proceed separately to the Main Magazine and IJ-Point turnoffs. Eenie Site and Daisy Mae-Kup will be cleared by the person going to IJ-Point turnoff. This may be done by placing the fragment warning sign in the center of Potrillo Drive and searching the site. Eenie Site may also be cleared by contacting Eenie-Site personnel and asking them to clear the site. The person conducting the clearance must not leave the Eenie-Site entrance until the site personnel have informed him that Eenie Site is clear. When the clearance operation has been completed, each operator will park the vehicle or place a sign to block the road, and then he will notify the Firing-Site Supervisor that the area is clear for firing. The same format is followed for radio transmission as given previously. Each assistant will remain at his vehicle until he is notified by the Site Supervisor that a safe condition exists.

For shots that may produce even longer range fragments, the clearance area may include the Bunker 107 (IJ Point) area. In this case, the Ridge Road gate must be double-locked and the area cleared as described below under Bunker 107 clearance. An additional vehicle or sign must be used to block Potrillo Drive at the IJ turnoff while the IJ area is being cleared.

- Bunker 6 (Meenie) and Bunker 8 (Minie)
  When Meenie-Site or Minie-Site personnel are firing a shot that might throw fragments to the adjacent site but that would not throw them to any portion of Potrillo Drive, the clearance operation should follow the outline described above, but it need extend no further than the Meenie/Minie road intersection with Potrillo Drive. A driver in a single vehicle may clear with a sign on the road or radio communication.
- Bunker 107 (IJ Point)
  - Firing operations will normally be limited to those shots whose nondirectional fragment ranges are less than 550 m (1800 ft), to reduce interference with Group M-4's operations. SOP M-8-87 addresses the operations in which longer fragment ranges are expected and in which M-4 firing sites must thus be cleared. Ridge Road at the entrance to IJ Point will be blocked with a sign or manned vehicle while the gate is being locked to ensure that no one can enter IJ Point during this time.
  - The chain link gate between TA-36 and TA-15 on Ridge Road will be locked with a chain and padlock at the start of the clearance procedure. The key for the padlock will be retained by the IJ Firing-Point Supervisor or his assistant during the firing operation. The chain will be removed after the firing operation has been completed or discontinued.

- An M-8 employee in a vehicle equipped with a radio will clear the area adjacent to the firing mound and then proceed to a safe distance along Ridge Road toward the main M-8 (TA-36) area. The road will be physically blocked to prevent access to the IJ Point firing area.
- Fragment shots that require clearance along the IJ-Point/M-4 road beyond the Ridge Road gate are covered in SOP M-8-87.

• Q-Site West (TA-14)
  - Clearance procedures for Q-Site are covered in SOP M-8-80.

7.2.3 Outside of normal working hours, when the firing sites are normally unoccupied, a modified clearance procedure will be used. The Group Office will be informed before 4:00 pm that a firing operation will take place outside of normal hours. The Group Office will notify the M-Division Office about shots fired outside the period 8:00 am to 5:00 pm on workdays, and at any time on weekends and holidays. For a late shot, the Group Office will leave the access gate in the closed position. A sign will be left at the gate actuator located in the Group Office stating which site and site supervisor is conducting a late firing. The site personnel are responsible for leaving the access gate in the open (upright) position after the firing operation has been completed. For shots to be fired before normal working hours, the site personnel shall close the hazard-area access gate before starting the firing sequence. Group Office personnel will notify the Security Communication Office (Station 100) that a firing outside of regular hours is scheduled, and they will give the location and approximate time that the shot will be fired. For weekend and holiday firing activity, when the Group Office is normally not operating, the Firing-Site Supervisor is responsible to verify that Station 100 has been properly notified.

• Hazard zone within individual site boundaries
  If the hazard zone is within a site's boundary, then the procedure outlined in Sec. 7.3.1 shall be followed for shots outside of normal working hours.
• Hazard zone extends beyond the individual firing-site boundary
  Only one Firing-Site Assistant is required to clear the hazard zone for shots fired outside of hours when the hazard zone extends beyond the firing-site boundary. When the Site Supervisor is ready to start the clearance procedure, his assistant will proceed to Lower Slobbovia in a radio-equipped vehicle and clear the entire area to IJ-Point turnoff or beyond, where a roadblock will be set up and maintained until the Site Supervisor notifies the individual that the firing area is in a safe condition. Warning signs will be used to prevent

access into the hazard zones that have been cleared, whenever the individual doing the clearance must leave Potrillo Drive to clear unoccupied areas.

7.2.4 If clear radio contact cannot be maintained between the helper stationed at the roadblock and the Firing-Site Supervisor, a relay may be set up through a telephone or another radio, provided that such action has the prior approval of the Group Leader and that the individual acting as the relay operator is familiar with the M-8 field operations.

7.2.5 To reduce the possibility of confusion or misinterpretations of radio messages, the following are suggested.

- Reserve the use of words such as "hold" and "stop" for emergency communications to have the site supervisor immediately terminate the firing sequence until further notification.
- Use the name of the individual being contacted by radio, in addition to the site designation, during any radio communications involving hazardous operations.
- Refer to M-8 sites by these designations in radio transmissions:
  BUNKER 3 (Eenie Site)
  BUNKER 6 (Meenie Site)
  BUNKER 8 (Minie Site)
  BUNKER 12 (Lower Slobbovia)
  BUNKER 107 (IJ Point)
  BUNKER 34 (Q-Site)
- During confirmation of the radio check and site clearances, proceed in sequence from Lower Slobbovia through to IJ-Point turnoff and Bldg. 80.
- Avoid and curtail nonemergency radio transmissions while any firing operation is in progress. In an emergency situation requiring radio use, all firing operations shall be suspended.

7.3 Firing Procedure

7.3.1 When the Firing-Site Supervisor receives notification that the hazard zone has been cleared, he will secure the firing-bunker door, unlock the firing circuit (thus starting it), and make certain that the horn is operating. Although the fire control system indicates when power is applied to the horn and to the siren, the Firing-Site Supervisor must confirm by listening that they are sounding. If the horn or siren fails to operate, he shall shut down the firing operation without firing. Firing operations with a nonoperational horn or siren may be executed only with explicit Group Leader approval.

7.3.2 He may connect the detonator cable to the firing system and proceed with any other preparatory activities required while the normal firing sequence progresses.

7.3.3 Just before actuating the "Arm Switch," the Firing-Site Supervisor will contact the assistant at each roadblock by radio to ensure clear radio contact. The format of this transmission shall be as follows:

"This is a radio check from BUNKER (No.)"

The helper shall respond:

"Received loud and clear at (Location)."

After the Firing-Site Supervisor has assured himself that all radio checks have been received, he may then proceed to fire the shot at his discretion. If any non-shot-related radio transmission occurs on the M-8 net between the radio check and firing of the shot, the radio check shall be repeated.

7.4 Misfires, Abort Conditions, and Tandem Warhead Test

7.4.1 If the Firing-Site Supervisor pushes the "FIRE" button and the shot fails to fire, he will try, without sounding the "All Clear," to determine whether the failure creates a potential hazard; in other words, a "hangfire." Without terminating the firing sequence, he will look for possible trivial causes (such as an unconnected detonator cable). If a trivial cause is determined, the Site Supervisor may attempt to fire the shot a second time after ensuring that no diagnostics have been jeopardized. If the cause is not located or is not trivial, he will disconnect the firing cables and wait five minutes. After this waiting period, a remote visual inspection will be performed for any sign of reaction (smoke, fire, etc.), either through the camera periscope, or by the person blocking the road. If a low-voltage propellant initiation system is being used, the Site Supervisor should wait 20 minutes. If no evidence is noted, the Site Supervisor will then terminate the firing sequence, as indicated below. If there are any unusual circumstances, conditions, or any indication of reaction, the Group Leader or Group Safety Officer will be contacted for special instructions on terminating the firing sequence. The warning signals should not be continued for longer than ten minutes unless a hazardous condition exists that cannot be safely removed. After finding the apparent cause of the misfire (except for trivial causes) and before attempting to fire the shot a second time, the Firing-Site Supervisor will contact the Group Leader or another Firing-Site Supervisor and review the operation and the corrective measures taken.

7.4.2 Shots involving projectiles (bullets, shaped charges, etc.) fired into targets containing energetic material are covered in SOP M-8-35.

7.4.3 For tandem warhead shots, in which there is a possibility that the first warhead detonates but the second does not, the site supervisor will disconnect the firing cables and wait five minutes. After the waiting period and a remote visual inspection, the Site Supervisor or his designee will inspect the area for damaged explosive.

7.5 Completion of Firing Operations

7.5.1 The firing operation is completed by disconnecting the detonator cables from the firing unit, permitting the siren to sound for an additional 60 seconds to allow time for the shrapnel to fall, and then locking the firing circuit. An "All Clear" of two short blasts of the siren is then sounded.

7.5.2 In an emergency shutdown of the firing operation before the charge is fired, the 60-second sounding of the siren may be omitted.

7.5.3 Notice of completion or cancellation of the firing operation must originate with the Firing-Site Supervisor and be transmitted to all involved personnel. The format for this transmission shall be as follows:

"The shot at BUNKER (No.) is ALL CLEAR and it is now safe to enter."

No one is to leave shelter until he/she receives this notice.

8.0 REQUIRED RECORDS

None.

9.0 REFERENCES

Los Alamos *Environment, Safety, and Health* manual, AR 6-6, "Explosives."

DOE Explosives Safety Manual

Group M-8 Standard Operating Procedures:

SOP M-8-SC, "M-8 Safety Charter"
SOP M-8-14, "Special Firing Procedure"
SOP M-8-35, "Projectile Impact on Energetic Material Targets"
SOP M-8-43, "Allowable Explosives"
SOP M-8-75, "Emergency Plan"
SOP M-8-80, "Firing Operations at TA-14 (Q-Site West)"
SOP M-8-87, "High-Hazard Shots at IJ Point"

10.0 ATTACHMENTS

A. Description and Use of Firing Unit

B. Specifications of M-8 Firing-Site Boundaries (Maps)

C. Evaluation of Fragment Hazards

D. Procedures for Elimination of Unexploded Explosive on the Firing Mound

ATTACHMENT A

Description and Use of Firing Units

Only exploding bridge-wire detonators (EBW) and electrically driven foil detonators are allowed for initiating high explosive during Normal Operations at M-8. Low-voltage initiators are used for propellant systems and experiments, such as the DDT tubes described in SOP M-8-53. EBW detonators require a high-voltage, high-energy electrical source to react with sufficient violence to initiate detonation in an acceptor explosive. The energy source routinely used is a capacitor discharge unit (CDU). Only CDUs approved by M-7 and/or the Explosives Review Committee are allowed for initiating high explosives for Normal Operations at M-8. This appendix describes the two categories of CDUs in current use at M-8. Other Normal Operations at M-8 include the use of two different low-voltage propellant initiators. This attachment also describes these two systems. Other systems may be used only after they are approved in new SOPs or SWPs.

High-Voltage Detonator Systems for High Explosives

Category I

This category is restricted to firing units in which both the CDU and the high-voltage supply are located inside the firing bunker. Generally, they are designed to fire several detonators on long (>5 m) firing cables. The standard 50-point unit is an example. All firing units in current use in this category attach to an external high-voltage supply. Detonator cable connections at the CDU are not made until after the hazard zone has been cleared and the firing sequence has been started. (See SOP main text, Secs. 7.3.1 and 7.3.2.)

Category II

Certain detonator types and shot assemblies must be fired with the CDU less than 2 m from the charge. In firing units allowed under this category, the CDU is located on the firing mound and the high-voltage supply is inside the firing bunker. The control circuit and triggering thyratron are also located in the bunker. When Category-II CDUs are in use, the detonator must be connected to the CDU before the hazard area is cleared of personnel. Because this is inherently a more hazardous operation, the following procedure shall be followed.

1. No detonator cable may be connected to a Category-II CDU unless the Firing-Site Supervisor directly authorizes it.
2. Before giving this authorization, the Firing-Site Supervisor will ensure that
   - the firing and test circuits are off and locked;
   - the high-voltage supply cable is disconnected at its interlock box located on the control panel inside the firing bunker;
   - the measured resistance across the high-voltage connector on the mound-access housing is 50±10 kΩ; and
   - the high-voltage cable from the CDU to the mound-access housing is connected. (This ensures that the safety shunt circuit is connected and operational.)

A shorting plug should be connected (and then removed) to the detonator end of the detonator cable to drain any residual charge. If a shorting plug is not available, a short piece of wire can be used, or an approved volt-ohmmeter (VOM) can be used to probe for residual voltage.

3. After these conditions have been met, the Firing-Site Supervisor may authorize the connection of the detonator cable to the CDU, shorting the detonator connector on the CDU before making the connection, as a final check that the circuit is safe.
4. After the hazard area has been cleared and the firing sequence started, the high-voltage supply may be connected to the CDU from within the firing bunker, as described in the main text (see Secs. 7.3.1 and 7.3.2).

No provisions are made in this procedure for firing units in which the CDU has an internal high-voltage supply. Until such provisions are made, this type of firing unit is not permitted.

Low-Voltage Initiator Systems for Propellants

Type 1. This is a low-voltage (≈50-V) CDU system used primarily to initiate rounds in the 105mm, 120mm, and 5-in. guns, the DDT experiments (SOP M-8-53) and rocket motors for sled track operations (SOP M-8-92). This CDU has an internal supply; however, it is powered through relays controlled by the firing key, arming switch, and firing switch.

Type 2. This is an isolated 115-V ac and 300-V ac output supply used primarily to operate solenoids that fire guns up to 7 in. The output is supplied by a relay controlled by the firing key, arming switch, and firing switch. Thus power cannot unintentionally be applied at the output of the CDU and operation is identical to the high-voltage CDUs. The 115-V ac and 300-V ac outlets use Reynolds 21 and 31 connectors, respectively, so that they cannot be confused. The supplies are interlocked so that voltage cannot be applied during test mode use.

ATTACHMENT B

Specifications of M-8 Firing-Site Boundaries

An agreement among the various M-Division firing groups defines the geographical boundaries of the land controlled by each group. The agreement is that fragments produced by one group will not encroach into the area controlled by another group without prior notification. Section 7.1.3 of this SOP requires that the affected group be given 24 hours' warning of the scheduled shot if the hazard area extends outside the land controlled by M-8. The attached maps show the boundaries separating TA-36 (M-8) from TA-15 (M-4). This boundary is slightly more than 700 m from Eenie Site (Fig. B-1) and 900 m from Meenie Site (Fig. B-2). The 300-m radius and the envelope of the 600- and 900-m radii centered about each site are also shown on maps (Figs. B-1 through B-6). The Q-Site firing radius is 90 m. In addition, each site has a topographic map, with these radii indicated at a scale of 1 in. = 400 ft. IJ Point is 600 m from PHERMEX and 620 m from Bldg. R-280 (Fig. B-5). Two additional hazard zones of 1200 and 1500 m are shown for IJ Point (Fig. B-5).

Pajarito Road lies within 600 m of Lower Slobbovia. Shots that could throw fragments to Pajarito Road are not to be scheduled at Lower Slobbovia without the preparation of a special SOP.

Within M-8, the individual Site Supervisors have access control of the land immediately surrounding their assigned firing sites and, as stated in this SOP, they will clear those areas of personnel during explosive test firings. When there is a possibility that fragments from a shot might fall in an area under the control of another M-8 site, an extended clearance procedure is required; it is detailed in the main text of this SOP. Each Site Supervisor is responsible for the final evaluation of the hazard radii for shots fired under his control.

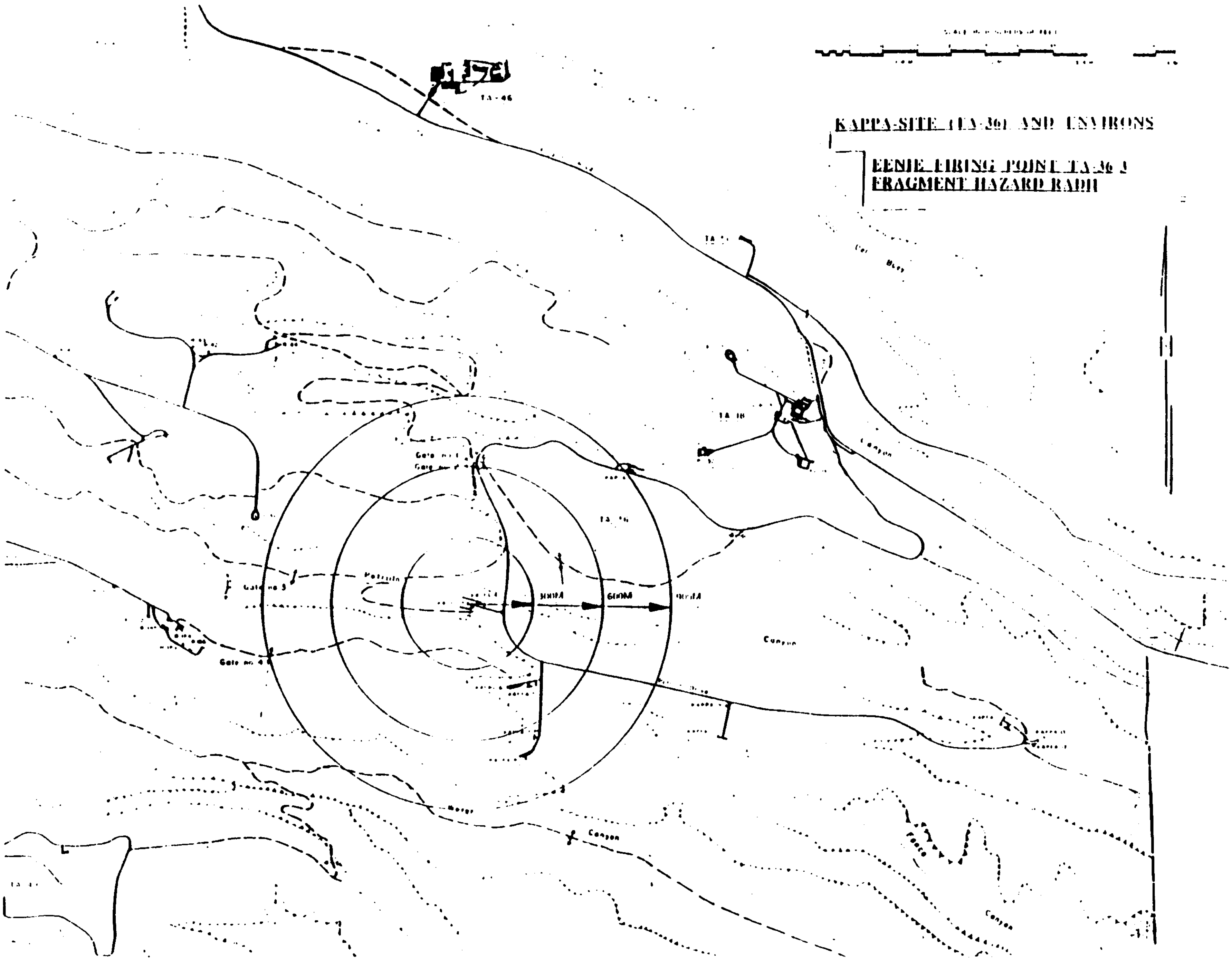
KAPPA-SITE (TA-36) AND ENVIRONS
EENIE FIRING POINT TA-36-3
FRAGMENT HAZARD RADII
TA-46
TA-18
Canyon
Canyon
Canyon
300M
600M
900M
Gate no 3
Gate no 4
Potrillo

Fig. B-1.

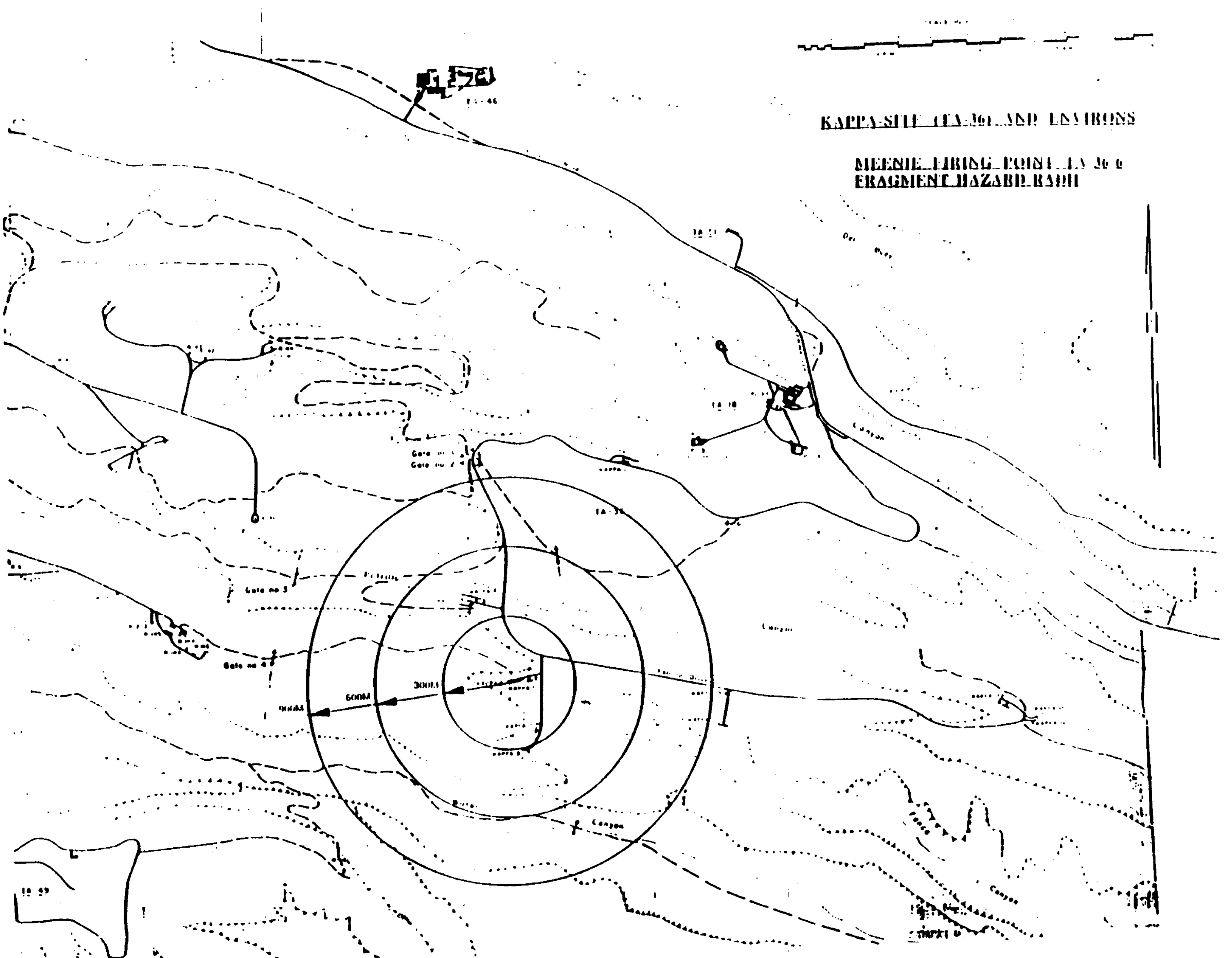
KAPPA SITE (TA-36) AND ENVIRONS
MEENIE FIRING POINT TA-36-6
FRAGMENT HAZARD RADII
Gate no 5
Gate no 4
300M
600M
900M
Canyon
TA-36
TA-18
TA-49

Fig. B-2

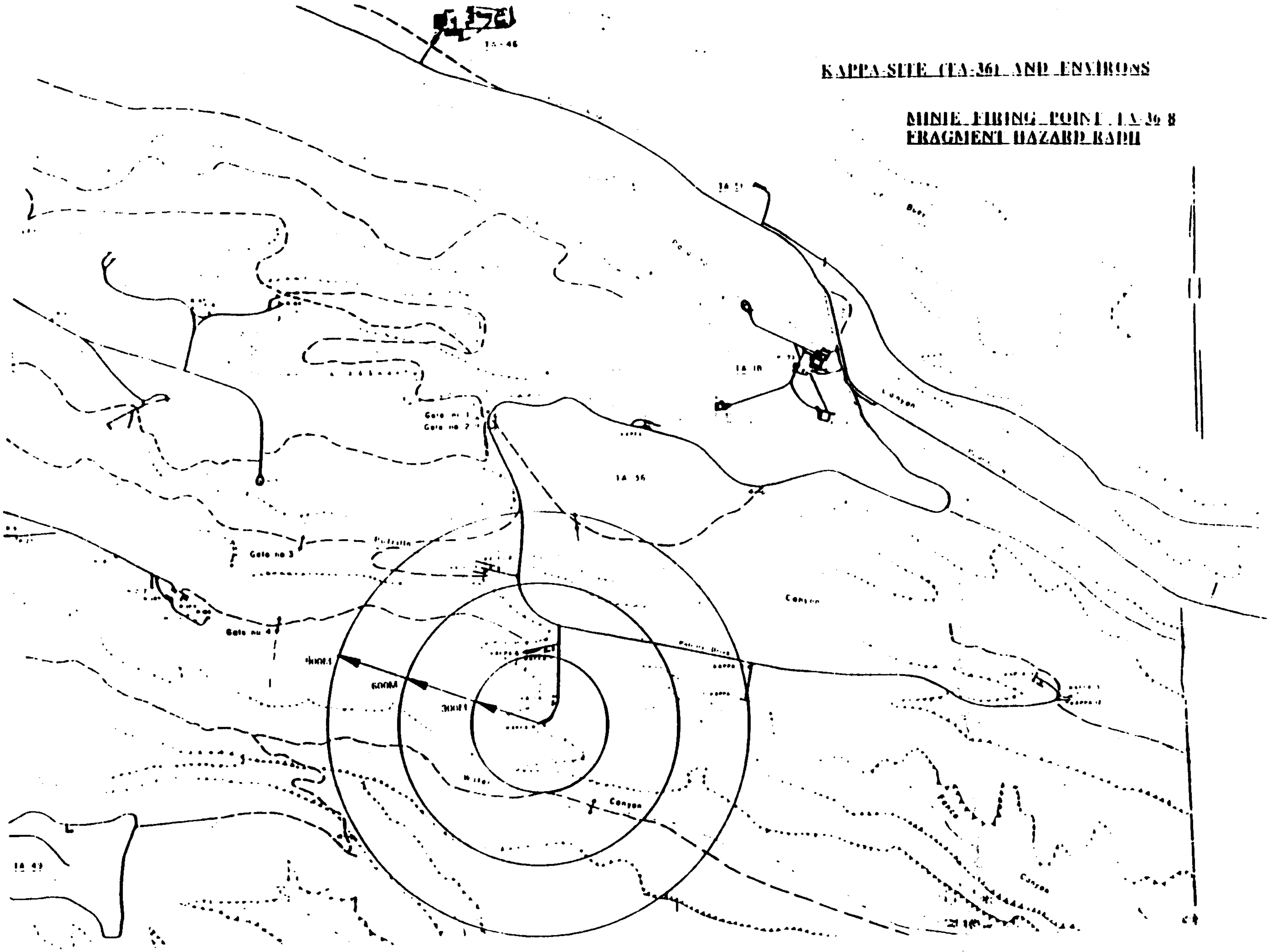
KAPPA SITE (TA-36) AND ENVIRONS
MINIE FIRING POINT TA-36-8
FRAGMENT HAZARD RADII
TA-46
TA-36
TA-10
TA-49
Gate no 1
Gate no 2
Gate no 3
Gate no 4
Canyon
Water
900M
600M
300M

Fig. B-3.

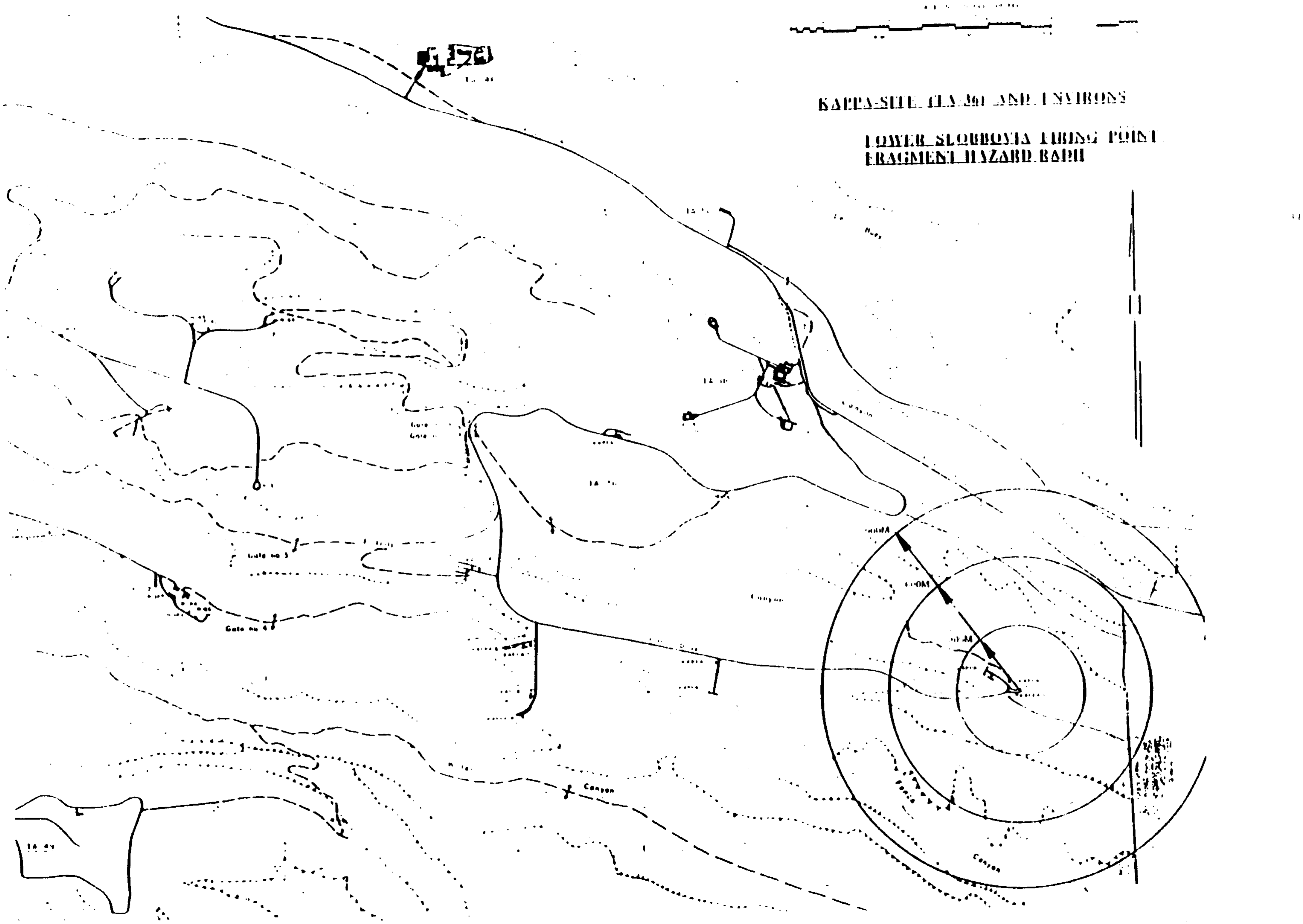
KAPPA-SITE (TA-36) AND ENVIRONS
LOWER SLOBBOVIA FIRING POINT
FRAGMENT HAZARD RADII
Canyon
Gate no 3
Gate no 4
Canyon
Canyon

Fig. I

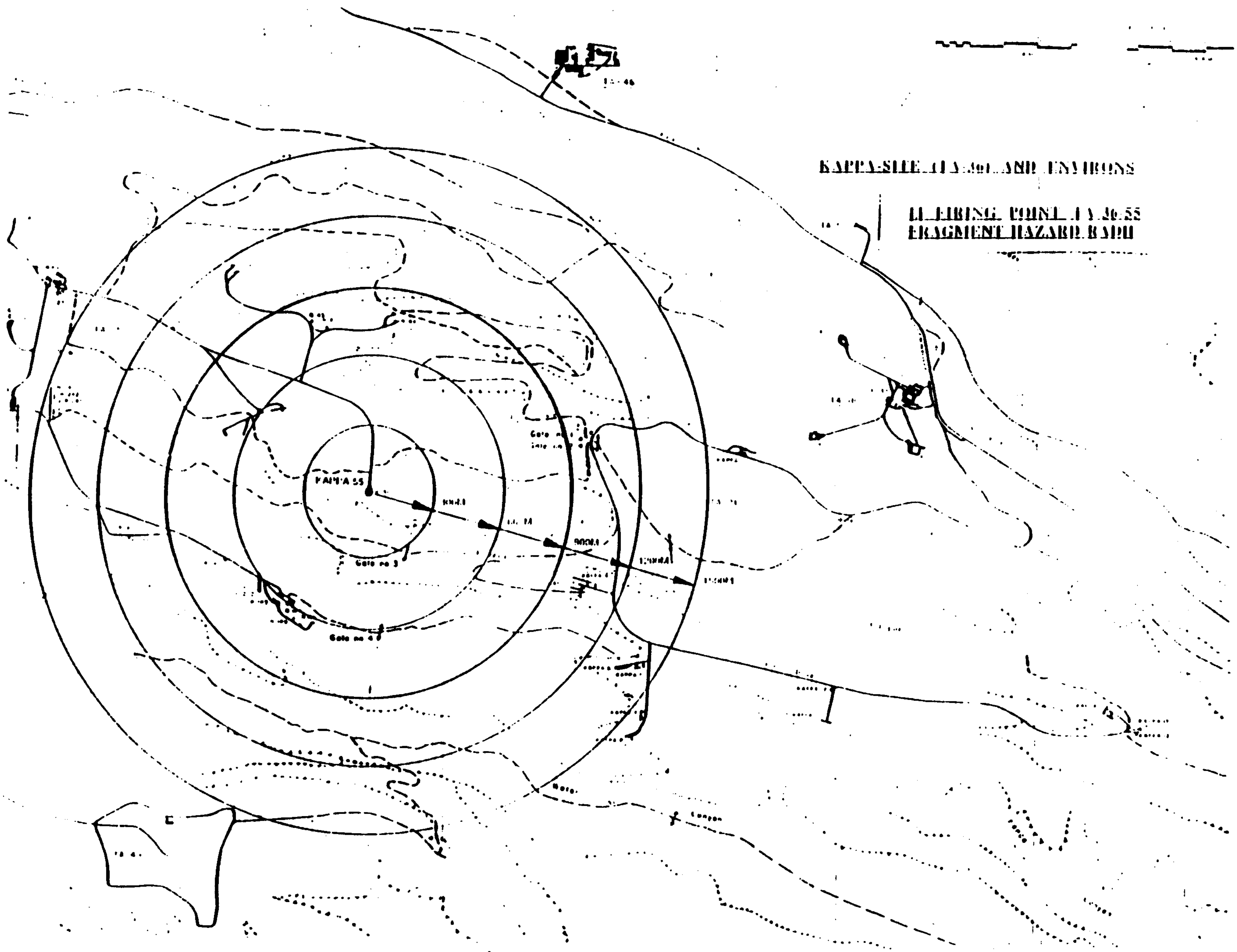
KAPPA SITE AND ENVIRONS
FIRING POINT TA-36-55
FRAGMENT HAZARD RADII
KAPPA 55
Gate no 3
Gate no 4

Fig. B-5.

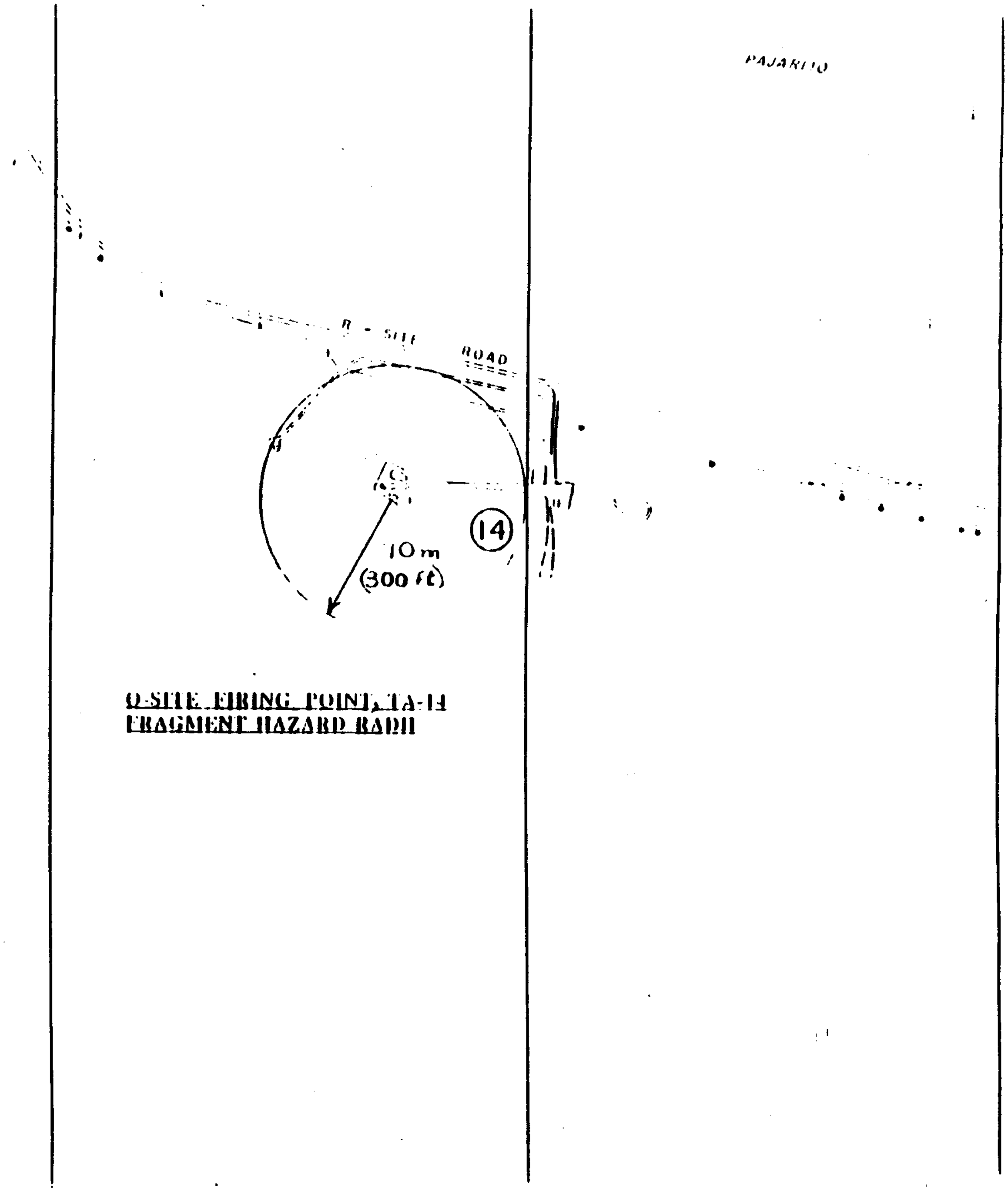
PAJARITO
R - SITE
ROAD
14
10m
(300 ft)
Q-SITE FIRING POINT, TA-14
FRAGMENT HAZARD RADII

Fig. B-6.

ATTACHMENT C

Evaluation of Fragment Hazards

The responsibility for evaluating the hazard radius for an explosive shot rests with the Site Supervisor. His evaluation must be based on his practical experience, but this attachment is to be used as a guide by firing-site personnel in this decision.

The precise solution of the range of a ballistic projectile with a defined shape is an extremely complex problem. In addition to the obvious factors, such as velocity, mass, and gravity, the additional factor of aerodynamic drag must be taken into account. For the marksman, the wind velocity (windage) must be corrected; i.e., the aerodynamic drag perpendicular to the line of flight between the muzzle and the target must be calculated. The artillery range officer may also correct for the humidity and the change in air density with altitude when he is trying to hit the desired target. The mathematics describing the ballistic trajectories is extremely complex and requires a computer for the solution.

At first thought, it might seem that gravity's effect on slowing down a fragment would provide a reasonable upper estimate of the hazard range and flight time, as given by

$$t = V_v/g, \qquad (1)$$

where t is the time for the fragment velocity to decrease to zero, V_v is the initial velocity in the vertical direction, and g is the gravitational constant. A typical free-surface velocity for an M-8 shot might be 1.5 mm/μs and g = 9.8 m/s², giving a vertical flight time of 153 s and a total flight distance of 115 km! Obviously incorrect! Therefore, it is essential that the aerodynamic drag be considered. Fragments from an explosive shot have no predictable shape, and it is impossible to predict the drag with precision.

A sufficiently accurate approximation for our purposes has been given by W. C. Davis (in M-3-QR-78-4). He has shown that the critical parameter for estimating the range is the characteristic length L given numerically by

$$L = \rho_m h, \qquad (2)$$

where ρ_m is the density of the metal in grams per cubic centimeter and h is the thickness in millimeters of the fragment measured in the direction of flight. For example, 12 mm of copper, 36 mm of Dural, or 5 mm of tuballoy have a characteristic length of 100 m. The initial velocity affects the flight distance of a fragment driven from a high explosive, but to a much smaller extent than the value of the characteristic length. The height and flight times for fragments driven vertically are given in Table C-I for three values of L and two values of initial velocity.

The calculation of the horizontal range is more complex than for the vertical trajectory. Davis has made a simplifying assumption and has found reasonable agreement with data for bullets. Figure C-1 summarizes the results obtained for initial velocities of 3.1, 1.0, and 0.5 mm/μs. To stay within a 600-m radius from a firing site, the characteristic length at 3.1 mm/μs must be less than 110 m, and for a velocity of 0.5 mm/μs, L must be less than about 200 m.

TABLE C-I

VERTICAL FLIGHT OF PROJECTILES FOR VARYING INITIAL CONDITIONS

L(m)	10	100	100	1000
h (mm) of fragment	1.2-mm copper	12-mm copper	12-mm copper	55-mm tuballoy
V_V (mm/µs)	3.1	3.1	1.0	3.1
y_{max} (m)	58	461	347	3450
t_{up} (s)	1.58	5.0	4.9	15.5
t_{down} (s)	6.5	16.9	13.2	41.7
t_{total} (s)	8.1	21.9	18.1	57.2

In evaluating the hazard radius for a shot, the Site Supervisor should use the results presented here as a guide. Barricades, such as sand-filled boxes and bags, and water-filled containers will substantially reduce the predicted range. Some metals tend to break into small fragments (Dural) and others tend to break into large fragments (nickel). The previous analysis uses only the thickness as a measure of the flight distance, whereas, in actuality, fragments tumble and large fragments will fly farther than small ones. We believe the range estimates presented here are a conservative basis for estimating hazard ranges. If more detailed estimates of fragment range are needed, both Jim Straight and Dave Fradkin have computer codes for range predictions.

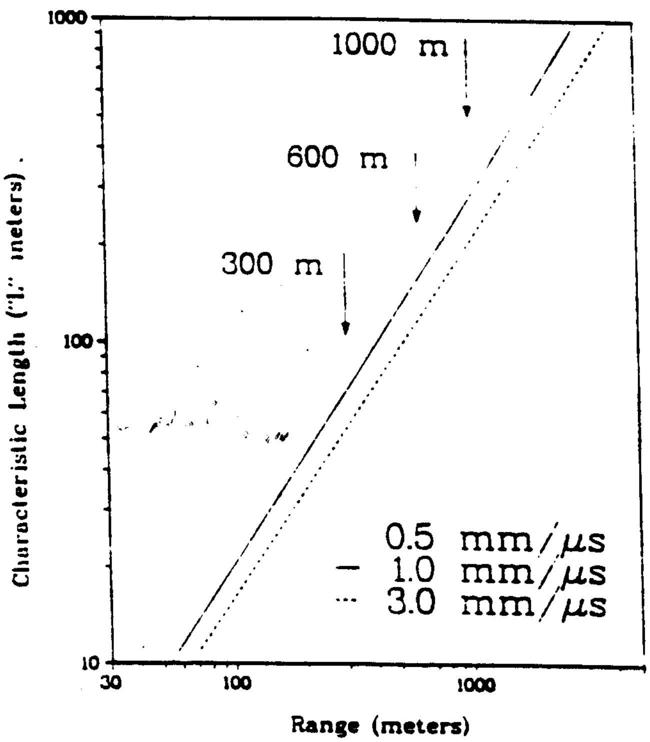

Figure C-1

ATTACHMENT D

Procedure for Elimination of Unexploded Explosive on the Firing Mound

There are instances in which unexploded explosives remain on the firing mound after a normal shot: for example, as a result of the armor/anti-armor program effort at the Laboratory. This attachment describes the steps to be taken to ensure personnel safety in these instances.

When a shot is set up that <u>may</u> leave tangible, unexploded material on the firing mound, the Firing-Site Supervisor will provide for a remote visual surveillance of the firing mound, as described in Section 7.4 of this SOP. The person surveying the scene must be knowledgeable about this shot setup and familiar with the various components of the shot to be able to describe the situation accurately. Often, with this type of shot, the unexploded HE has been set afire, and the HE, as well as any flammable materials, such as wood, sandbags, or Lexan, may be smoldering or ablaze.

If the knowledgeable observer reports no visible fire or smoke, the Firing-Site Supervisor will wait 10 minutes and have a second visual check made of the scene. If there is still no visible fire or smoke, then one person designated by the Site Supervisor shall cautiously approach the firing mound and resurvey the scene. If the person is sure that no smoke or fire is visible, then operations may proceed as usual, except that a careful inspection must be made for unconsumed HE.

If the observer indicates that he or she sees smoke or fire, then the Site Supervisor, along with the observer, shall determine the extent of the problem. The Site Supervisor will then notify the Group Leader, Deputy Group Leader, Safety Officer, or the designated chemistry and HE expert for the group, about the situation. This person will then take appropriate action, as dictated by the particular circumstances, to resolve the problem.

Additional information on how to handle damaged targets containing energetic material is given in SOP M-8-35.

Appendix C

The New Mexico Environment Department's August 17, 1995, Letter to the Department of Energy/Los Alamos Area Office Regarding Comments Concerning Ground-Water Contamination and Protection at Los Alamos National Laboratory (LANL), Los Alamos, New Mexico

State of New Mexico
ENVIRONMENT DEPARTMENT
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2850

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

17 August 1995

Mr. Larry Kirkman
Acting Area Manager
Department of Energy
Los Alamos Area Office
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

RE: Comments Concerning Ground-water Contamination and Protection at Los Alamos National Laboratory (LANL), Los Alamos, New Mexico

Dear Mr. Kirkman:

The New Mexico Environment Department (NMED), Department of Energy Oversight Bureau (DOE OB) and Hazardous and Radioactive Material Bureau (HRMB) staff have assessed LANL's ground-water protection program, and have concluded that several problems concerning ground-water contamination and protection exist. The following summarizes major concerns of the NMED in relation to ground-water protection at LANL:

- From 1989 to 1993, water at approximately 271 ground-water monitoring stations (wells) exceeded Department of Energy, Environmental Protection Agency, New Mexico State drinking water standards or maximum contaminant levels, and NMED Water Quality Control Commission (WQCC) standards.

- Results of historical tritium concentration trend analyses, performed for seven LANL regional aquifer monitoring wells indicate that past laboratory releases of tritium-contaminated water may have commingled with the regional aquifer.

- LANL's Environmental Surveillance group recently released preliminary data which indicate that the regional aquifer near production well O-4 contains strontium-90 at levels four(4) times the New Mexico State drinking water standard and NMED WQCC standard.

- o Both LANL and NMED DOE OB analytical data obtained from on-site and off-site springs are showing elevated concentrations of chlorinated solvents, high explosives, nitrates/nitrites as nitrogen and radionuclides.

- o Preliminary modeling of the water balance in Mortandad Canyon by NMED suggests radionuclide-bearing effluent from LANL's liquid radioactive waste treatment facility(Tech Area 50) can leak out of the shallow(alluvium) aquifer and thus percolate towards the regional aquifer.

The above conditions warrant NMED's previous recommendations to develop a site-wide ground-water monitoring system to ascertain the impacts of laboratory operations to the groundwater regime. Currently, the impact to human health and the environment is unknown. **A plan is required to determine adequately the effect past, current, and future laboratory operations have on the ground-water regime.** The inadequacy of LANL's current ground-water monitoring system, the lack of basic hydrologic information, and the lack of compliance with both HSWA and RCRA ground-water monitoring requirements have previously been conveyed by NMED through memoranda, presentations, and letters. *(c.f. NMED internal letter, August 26, 1992; NMED letter to Jerry Bellows, November 25, 1992; NMED Initial Ground-Water Assessment Report, December 1992; NMED internal memo, February 5, 1993; NMED presentation at San Ildefonso, February 16, 1993; NMED/LANL meeting February 19, 1993; NMED letter to Diana Webb, March 10, 1993; NMED letter to Diana Webb, July 1, 1993; NMED letter to distribution, August 6, 1993; NMED memo to EPA, August 5, 1993; NMED internal memo, November 23, 1993; NMED letter to Diana Webb, February 28, 1994; NMED internal memo, February 22, 1994; NMED internal presentations, May 13, 1994; NMED letter to Joseph Vozella, July 7, 1994; NMED letter to EPA, January 23, 1995; NMED letter to EPA, January 24, 1995; NMED/DOE meeting, April 13, 1995; NMED letter to Larry Kirkman, May 30, 1995; NMED internal memo, July 5, 1995).*

Basic geology, hydrogeology, and pathways for contaminant transport have not been adequately addressed to date. At present, the following fundamental hydrogeologic issues/questions remain unresolved at LANL.

- Individual zones of saturation beneath LANL have not been adequately delineated, and the "hydraulic interconnection" between these is not understood. A facility-wide description of the hydrogeologic characteristics affecting ground-water flow beneath the facility cannot be made without adequate delineation of the perched-intermediate aquifer(s) beneath LANL.

- The recharge area(s) for the main and perched-intermediate aquifers have not been identified. It is unknown at this time if any significant quantity of water is recharging the main aquifer through fracture-fault zones which occur on the Pajarito Plateau. Characterization of these site-wide fault zones as potential pathways for aqueous migration is not complete. It is unknown what effect, if any, these zones may have on the direction of ground-water flow and hydraulic gradient of the main and perched-intermediate aquifers.

- The ground-water flow direction(s) of the main aquifer and perched-intermediate aquifer(s), as influenced by pumping of production wells are unknown.

- Aquifer characteristics cannot be determined without additional monitoring wells installed within specific intervals of the various aquifers beneath the facility. Locations of wells designed for aquifer testing cannot be addressed adequately without the delineation of individual zones of saturation beneath LANL.

At present, it appears that several different organizations(i.e., Environmental Restoration, Environmental Surveillance and Earth and Environmental Science divisions) at LANL are performing activities related to ground-water protection, monitoring and characterization. NMED does not consider that LANL's individual programs are adequately addressing the necessary requirements for a comprehensive ground-water protection program.

The hydrogeologic projects underway lack the integration necessary to meet the specific requirements of the HSWA permit and to address the fundamental hydrogeologic issues mentioned above. The lack of knowledge surrounding these fundamental hydrogeologic issues does not allow for compliance with the regulatory requirements of a site-wide characterization.

NMED is currently evaluating what work needs to be conducted and to what level of detail to assure compliance with both the HSWA hydrogeologic permit requirements and the requirements for ground-water monitoring of RCRA regulated units. This evaluation should be completed in October, 1995, and provided to EPA and then available to LANL.

During the course of NMED's investigation for the RCRA hydrogeologic evaluation, it has become evident to NMED that a RCRA site-wide hydrogeologic workplan should be developed and submitted to NMED and EPA for review and approval. A site-wide hydrogeologic workplan developed under the driver of RCRA will provide a mechanism to assure a compliance schedule with specific tasks to meet the permit objectives. The workplan should address both the HSWA hydrogeologic permit requirements and RCRA regulatory ground-water monitoring requirements.

Thank you for your attention in this matter. Should you have any questions concerning either technical or regulatory issues please contact Ms. Teri Davis of HRMB at (505) 827-1560. If you have any questions concerning technical matters please contact Mr. Michael Dale of DOE OB at (505) 672-0449.

Sincerely,

Ed Kelley

Ed Kelley PhD, Director, Water and Waste Management Division
New Mexico Environment Department

cc: Theodore Taylor, DOE LAAO, AAMEP, MS A316
Joseph Vozella, DOE LAAO, MS A316
Ivan Trujillo, DOE LAAO, MS A316
Matt Johansen, DOE LAAO, MS A316
Ken Zamora, Scientech/LAAO, MS A316
Barbara Driscoll, EPA Region 6
Gilbert Sanchez, San Ildefonso Pueblo, Environmental Director
Mark Weidler, NMED, Secretary
Peter Maggiore, NMED, Environmental Protection Division
Neil Weber, NMED, Chief, DOE Oversight Bureau
Benito Garcia, NMED, Chief, HRMB
Jim Piatt, NMED, Chief, SWQB
Marcy Leavitt, NMED, Chief, GWPRB
Sig Hecker, LANL, Laboratory Director, MS A100
Tom Baca, LANL, EM, MS J591
Jorg Jansen, LANL, EM/ER, MS M992
Steve Rae, LANL, ESH-18, MS K490

Appendix D

Baseline Human Health and Ecological Risk Assessment for Technical Area 14

BASELINE HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT FOR TECHNICAL AREA 14

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List of Acronyms and Abbreviations

amsl	above mean sea level
cm^2	square centimeter(s)
COPC	chemical of potential concern
COPEC	chemicals of potential ecological concern
EPA	U.S. Environmental Protection Agency
g	gram(s)
g/m^2	gram(s) per square meter
g/m^2-hr	gram(s) per square meter per hour
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
hr	hour(s)
HQ	hazard quotient
hr/day	hours per day
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
kg	kilogram(s)
kg/day	kilogram(s) per day
kg/mg	kilogram(s) per milligram(s)
L/cm^3	liter(s) per cubic centimeter(s)
L/day	liter(s) per day
LANL	Los Alamos National Laboratory
LD_{50}	lethal dose to 50 percent of the test population
LOAEL	lowest-observed-adverse-effect-levels
m/sec	meter(s) per second
m^2	square meter(s)
m^3	cubic meter(s)
m^3/day	cubic meter(s) per day
m^3/hr	cubic meter(s) per hour
mg	milligram(s)
mg/cm^2	milligram(s) per square centimeter(s)
mg/day	milligram(s) per day
mg/hr	milligram(s) per hour
mg/kg	milligram(s) per kilogram

List of Acronyms and Abbreviations (Continued)

mg/kg-day	milligram(s) per kilogram(s) per day
mg/L	milligram(s) per liter
mg/m^3	milligram(s) per cubic meter(s)
μg	micrograms
$\mu g/m^3$	micrograms per cubic meter(s)
N	number of samples
NCP	National Contingency Plan
NOAEL	no-observed-adverse-effect-level
OB/OD	open burning/open detonation
ppm	parts per million
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration
RfD	reference dose
RME	reasonable maximum exposure
SF	slope factor
TA	technical area
UCL	upper confidence limit
UTL	upper tolerance limit
yr	year

1.0 Introduction

This document addresses the overall baseline human health and ecological effects of exposure to chemicals of potential concern (COPC) in surface soil and sediment, surface water, and air at Technical Area (TA) 14 at Los Alamos National Laboratory (LANL).

The human health risk assessment is an estimation of potential risk which may occur at TA-14 under normal operating conditions. This risk assessment was performed in accordance with the "Risk Assessment Guidance for Superfund" (RAGS) (U.S. Environmental Protection Agency [EPA], 1989) and additional guidance provided by EPA.

The ecological risk assessment process performed for the TA-14 site is a screening level assessment. Methodology used is based on screening level guidance presented by EPA (EPA, 1992; 1996a; 1997) and by Wentsel et al. (1996) and is consistent with a phased approach. This assessment utilizes conservatism in the estimation of ecological risks; however, ecological relevance and professional judgement are also incorporated, as recommended by EPA (1996a) and Wentsel et al. (1996), to ensure that the predicted exposures of selected ecological receptors reasonably reflect those expected to occur at the site.

This report consists of the following major elements: identification of COPC (Section 2), human health risk assessment (Section 3), and ecological risk assessment (Section 4).

2.0 Identification of Chemicals of Potential Concern

This section identifies the COPC for TA-14 at LANL . Pertinent data collection considerations are discussed, and the data evaluation process is presented.

Data collected during the investigations were evaluated for use in this risk assessment in accordance with EPA guidance (EPA, 1989). This process included evaluating the sample collection and analytical methods used, evaluating the quality of the data, and selection of the COPC. The goal of the COPC selection process was three-fold: (1) to identify those chemicals that are likely to be site-related, (2) to determine the acceptability of the analytical data for use in the risk assessment, and (3) to focus the risk assessment on those constituents that represent the dominant potential risks at these sites. The various analytical data used are provided in Appendices E and F and Attachment 4-9 of the OB/OD Part B Permit Application (Revision 1.0), or at the end of this document.

2.1 Site Descriptions

TA-14 is located within the west central area of LANL on the southern edge of Three-Mile Mesa. It is bounded on the south by Cañon del Valle and on the north by Three-Mile Canyon. The mesa tops are primarily woodlands and savanna. Topography includes steep canyon cliffs, a fairly level wooded mesa top, forested slopes, and canyon bottoms. Mesatop elevations range from approximately 7,350 to 7,450 feet above mean sea level (amsl); canyon bottom elevations range from 7,110 to 7,400 feet amsl.

2.2 Methodology for Selection of Chemicals of Potential Concern

This section presents the procedure used to identify the COPC for TA-14. The analytical data were organized by medium into individual data sets (e.g., surface soil data). For individual data sets that contained nondetections (i.e., data which were "U" or "UJ" qualified), the detection limit of the nondetected result was divided by two before any statistical calculation was performed. Samples with duplicates were averaged and treated as a single result for any statistical calculations. Both of these steps are in accordance with EPA guidance (EPA, 1989). All statistical calculations were performed using STATISTICA® (Statsoft, 1996) for Windows, Version 5. The following statistical manipulations were performed on each of the individual data sets:

- Frequency Sampled - Number of samples that were collected and analyzed for a particular chemical in a specific medium. Field duplicate samples for the same sample locations were averaged and counted as a single sample.

- Number of Detections - Number of detections of a particular chemical in a specific medium.

- Maximum Concentration - Highest concentration of a particular chemical in a specific medium.

- Minimum Concentration - Lowest concentration of a particular chemical in a specific medium. This value may be one half of the detection limit for data sets which contain only nondetections.

- Mean Concentration - Arithmetic mean of a particular chemical in a specific medium.

- Standard Deviation - Sample standard deviation of a particular chemical in a specific medium.

- Upper 95-Percent Confidence Limit of the Mean (UCL) - Upper 95-percent UCL was calculated for a chemical in a specific medium using the Student's *t* statistic and assuming that the analytical data were normally distributed.

- Upper 95-Percent Upper Tolerance Limit (UTL) - Upper 95-percent UTL was calculated for a chemical in a specific medium for comparison to background.

Subsequent to the statistical calculations, analytical results were screened using criteria from EPA guidance (EPA, 1989) to focus the risk assessment process on those constituents that were COPC. The screening criteria included the following:

- COPC which were 100 percent nondetections for a given medium were eliminated from consideration.

- If inorganic chemicals were present in soil at naturally occurring background levels, they were eliminated from consideration. The 95-percent UTL for the TA-14 analytical data were compared to 95-percent UTL regional background concentrations. If the TA-14 UTL was less then the regional background UTL, the inorganic chemical was eliminated as a COPC.

- All metals which are considered essential nutrients were eliminated from consideration.

- Due to the presence of several laboratory contaminants in virtually all environmental sampling efforts, the EPA has developed guidance for eliminating these contaminants from consideration as COPC. A chemical is excluded from consideration if the maximum sample concentration does not exceed 10 times the highest blank concentration for all common laboratory contaminants (these include 2-butanone, acetone, methylene chloride, toluene, and phthalate) or does not exceed 5 times the highest blank concentration for other chemicals (EPA, 1989). This criterion was developed by the EPA to prevent the inclusion of chemicals that are most likely sampling or analytical artifacts. Although no COPC were detected in the TA-14 blank samples, it is possible that both of the phthalate compounds detected in surface soil samples from TA-14 are laboratory contaminants.

- Constituents that are infrequently detected may be artifacts in the data due to sampling, analytical, or other problems (EPA, 1989). Constituents were eliminated from further consideration as COPC if they were detected in 5 percent or less of the data from a particular source area. Class A carcinogens, however, were not eliminated on the basis of frequency of detection.

The remaining COPC were carried through the risk assessment process.

2.3 Chemicals of Potential Concern

Existing analytical data for surface soil and surface water at TA-14 are summarized in Tables 2-1 and 2-2. Included in this summary are the number of samples (N), the number of detections, the maximum and minimum values, mean, standard deviation, 95-percent UCL, 95-percent UTL, the LANL regional background value (if it exists), the determination of whether the analyte is a COPC, and the reason for exclusion if the analyte is not a COPC.

Table 2-3 summarizes the air modeling results for air emissions from the open detonation of wood and plastic waste at TA-36. TA-36 was selected as a worst-case waste treatment and receptor location for the modeled scenario because its treatment capacity (2,000 pounds) greatly exceeds the treatment capacity of the TA-14 OD unit (20 pounds). Open detonations at TA-14 are smaller in size and at a greater distance from potential receptors. Therefore, under baseline conditions, air emissions due to routine operations at TA-14 are minimal (i.e., no risk to potential occupational receptors).

Table 2-1
Surface Soil Sampling Summary
LANL Technical Area 14

Chemical of Potential Concern	N	Number of Detects	Minimum	Maximum	Mean	Standard Deviation	95 % UCL[a]	95% UTL[b]	Background 95% UTL	Chemical of Concern	Reason for Exclusion
Barium[c]	12	12	120	550	249	144	340	638	1140	No	e
Total Beryllium[c]	12	12	1.8	4.6	2.94	0.80	3.45	5.11	3.31	Yes	
Cadmium[c]	12	12	0.08	3.4	0.53	0.92	1.11	3.02	2.70	Yes	
Chromium[c]	12	12	5.2	17	9.72	3.41	11.9	18.9	34.2	No	e
Total Lead[c]	12	12	13	79	37.5	18.30	49.13	87.0	39	Yes	
HMX[c]	25	25	1.1	876	209	200	292	665	NA	Yes	
RDX[c]	25	9	0.15	4.3	0.89	1.13	1.36	3.46	NA	Yes	
Tetryl[c]	25	4	0.2	12.7	0.96	2.57	2.02	6.82	NA	Yes	
TNT[c]	25	10	0.2	181.6	11.0	36.72	26.2	94.6	NA	Yes	
Bis-2-Ethylhexylphthalate[d]	25	3	165	1100	238	219	329	738	NA	Yes	
Di-n-Octyphthalate[d]	25	1	165	690	186	105	229	425	NA	No	f
Pyrene[d]	25	1	165	3800	310	727	610	1966	NA	No	f

[a]UCL = Upper Confidence Limit.
[b]UTL = Upper Tolerance Limit.
[c]Sampling results have units of ppm.
[d]Sampling results have units of ppb.
e = Not a chemical of potential concern because on-site concentrations are less than background.
f = Not a chemical of potential concern based on frequency of detection.
N = Number of samples.

Table 2-2
Surface Water Sampling Summary
LANL Technical Area 14

Chemical of Potential Concern	N	Number of Detects	Minimum	Maximum	Mean	Standard Deviation	95 % UCL[a]	95% UTL[b]	Background 95% UTL	Chemical of Concern	Reason for Exclusion
Barium[c]	10	10	25	120	63.4	32.9	87.0	158	ND[d]	Yes	
Total Beryllium[c]	10	7	0.05	3	0.79	0.93	1.45	3.46	ND	Yes	
Cadmium[c]	10	4	0.05	2.8	0.70	0.98	1.40	3.50	ND	Yes	
Chromium[c]	10	10	1.9	5.8	3.79	1.28	4.71	7.48	ND	Yes	
Total Lead[c]	10	8	0.5	11	3.23	3.31	5.59	12.7	ND	Yes	

[a]UCL = Upper Confidence Limit.
[b]UTL = Upper Tolerance Limit.
[c]Sampling results have units of ppb.
[d]ND = No data.
N = Number of samples.

Table 2-3
Air Quality Modeling Summary
LANL Technical Area 14

Chemical of Potential Concern	Air Concentrations at Pajarito Road (800 m NNE)	Air Concentrations at White Rock (2980 m ESE)	Ambient Air Quality Standard
Carbon Monoxide (1-hour average)	0.16 mg/m^3	0.02 mg/m^3	2.0 mg/m^3
Sulfur Dioxide (24-hour average)	0.054 ug/m^3	0.02 ug/m^3	5.0 ug/m^3
Lead (3-month average)	4.3×10^{-6} ug/m^3	1.6×10^{-6} ug/m^3	0.03 ug/m^3

3.0 Human Health Risk Assessment

This human health risk assessment was performed in accordance with RAGS (EPA, 1989) and additional EPA guidance.

3.1 Exposure Assessment

This section identifies exposure pathways and quantifies chemical intakes. The purpose of this exposure assessment is to estimate the type and magnitude of exposure to humans.

3.1.1 Exposure Pathways

For exposure and potential risks to occur, complete exposure pathways must exist. A complete pathway requires the following elements (EPA, 1989):

- A source and mechanism for release of contamination,
- A transport or retention medium,
- A point of potential human contact (exposure point), and
- An exposure route at the exposure point.

If any one of these elements is missing, the pathway is not considered complete. Following is a brief discussion of the exposure pathway elements.

Contamination sources and the transport /retention medium are the same as those addressed in Section 2.3. At TA-14, the primary medium of concern is surface soil.

Exposure points are locations of human contact with contaminated media. Exposure points consider human activity patterns and the location of potentially exposed individuals relative to the location of contaminated media. For this assessment, contact with potentially contaminated media takes place as a result of occupational exposure. To maintain the conservative methodology of RAGS (EPA, 1989), the contact point for soil and surface water contamination in all exposure scenarios is located at the contaminant source.

The following three exposure routes were examined:

- Ingestion,
- Inhalation (both dust and modeled air concentrations), and
- Dermal contact.

Because land use at LANL and TA-14 is restricted, the only potential current on-site user is an occupational receptor. The potentially complete exposure pathways include exposure to surface soil, surface water (under limited conditions), and air. Figure 3-1 illustrates the site conceptual model for TA-14. Table 3-1 lists the complete human exposure pathways for current land use. This table also indicates which pathways have been selected for risk characterization and presents the rationale for inclusion or exclusion of each pathway.

Since land use at TA-14 is expected to remain under DOE control, future pathways at TA-14 will be similar the current pathways listed above. Therefore, this risk assessment assumes that any restrictions currently in place will remain in place for the foreseeable future. Under these conditions, the current and future human health risks are identical (i.e., the pathways and receptors are the same). For the remainder of the document, these risks will be linked to an occupational receptor with no further consideration of whether the exposure is current or future.

3.1.2 Quantification of Exposure

This section describes the estimation of exposure (intake) for the COPC that may come into contact with human receptors. The process involves the following:

- Identification of applicable human exposure models and input parameters,
- Determination of the concentration of each chemical in environmental media at the point of human exposure, and
- Estimation of human intakes.

For each potentially complete future exposure pathway identified in Section 3.1.1, a reasonable maximum exposure (RME) scenario has been developed. The RME is the highest exposure that is reasonably expected to occur at a site (EPA, 1989). The intent of the RME, as defined by EPA, is to estimate a conservative exposure case (i.e., well above the average case) that is still within the possible range of exposures. The RME is both protective and reasonable but is not the worst possible case (EPA, 1991a).

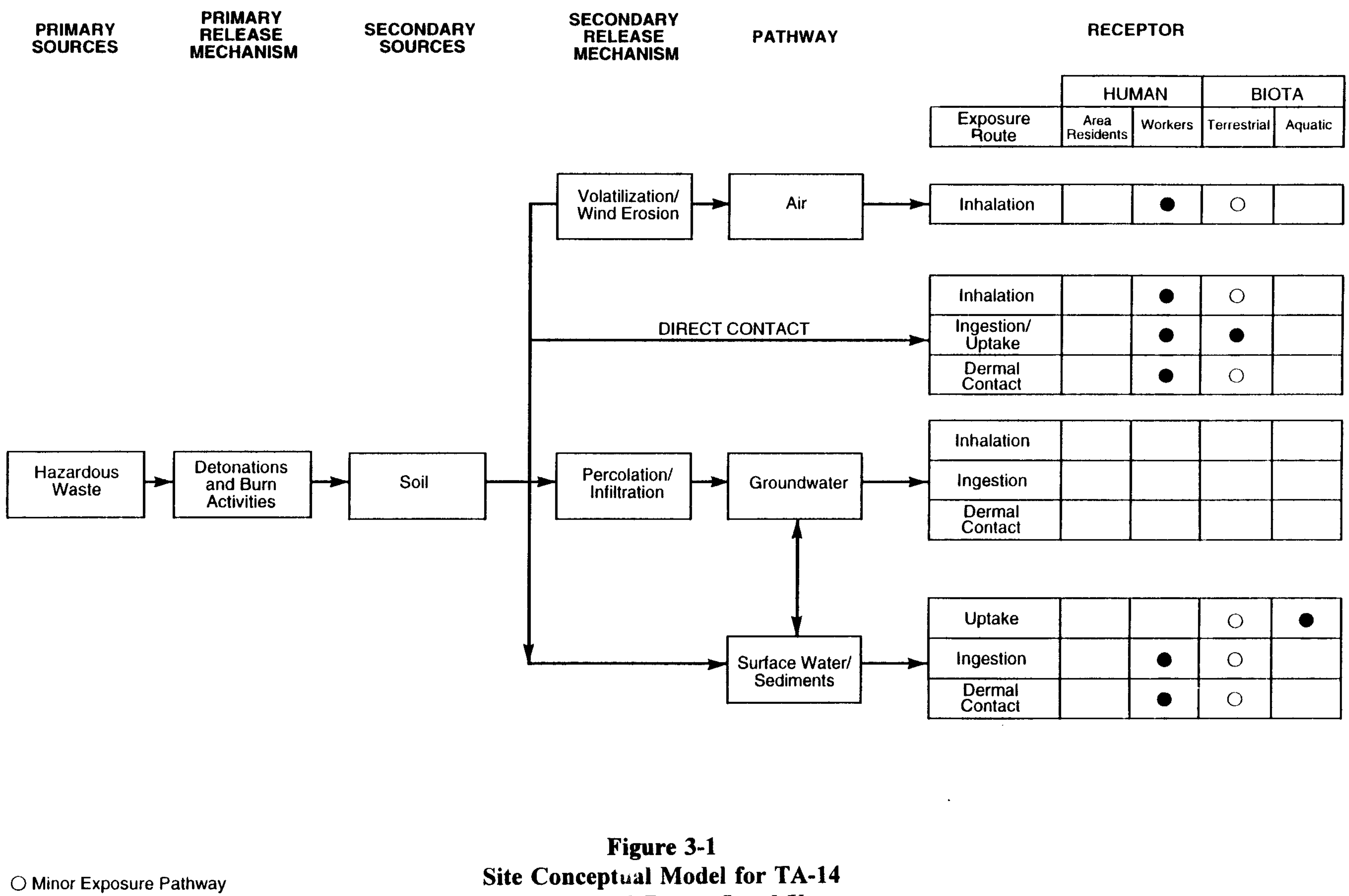

Figure 3-1
Site Conceptual Model for TA-14
Current and Future Land Use

Table 3-1
Potentially Complete Human Exposure Pathways at LANL Technical Area 14

Environmental Medium	Exposure Route	Potentially Exposed Population	Pathway Selected for Evaluation	Reason for Selection or Exclusion
Surface Soil	Inhalation Ingestion Dermal Contact	Residential Recreational	No	No current or future on-site residents or recreational users at TA-14.
Surface Soil	Inhalation Ingestion Dermal Contact	Occupational	Yes	Potential intermittent occupational exposure is likely under current and future operating conditions.
Surface Water	Inhalation Ingestion Dermal Contact	Residential Recreational	No	No current or future on-site residents or recreational users at TA-14.
Surface Water	Ingestion Dermal Contact	Occupational	Yes	Potential intermittent occupational contact with surface water is unlikely. At TA-14, there is no permanent on-site surface water (all surface water is due to runoff). However, exposure and the associated risk due to contact with surface water were calculated as a worst-case scenario.
Air[a]	Inhalation	Occupational	Yes	Air modeling calculated COPC air concentrations to a potential occupational receptor.
Groundwater	Inhalation Ingestion Dermal Contact	Residential Recreational Occupational	No	No current or projected use of groundwater at TA-14.
Subsurface Soil	Inhalation Ingestion Dermal Contact	Residential Recreational Occupational	No	No subsurface soil analytical information was available for TA-14. However, due to the activities which occur at the site, waste burning and detonations, surface soil is the only media of concern. Surface soil COPC are expected to be the risk drivers.

[a]Air refers specifically to evaluating exposure using air modeling data. Potential exposure by inhalation of constituents from other media (e.g., soil) is presented with those media.

3.1.2.1 Exposure Models

The primary source for the exposure models used in this baseline risk assessment is RAGS (EPA, 1989). Shown below is the generalized equation for calculating chemical intakes:

$$I = C \frac{CR \times EFD}{BW \times AT}$$

where

I	=	Intake; the amount of chemical at the exchange boundary (milligrams per kilogram [mg/kg] body weight per day [mg/kg-day]).
C	=	Chemical concentration at the exposure point; the concentration contacted over the exposure period (e.g., mg per liter [mg/L] water or mg/kg soil).
CR	=	Contact rate; the amount of contaminated medium contacted per unit time or event (e.g., mg per day [mg/day] soil ingestion rate or cubic meters per hour air inhalation rate).
EFD	=	Exposure frequency and duration; describes how often and how long exposure occurs. Often calculated using two terms (EF times ED).
EF	=	Exposure frequency (days/year).
ED	=	Exposure duration (years).
BW	=	Body weight; the average body weight over the exposure period (kg).
AT	=	Averaging time; period over which exposure is averaged (days).

Each model for exposure to COPC at TA-14 is summarized below.

Ingestion of Soil and Surface Water

For estimating chemical intake from ingestion of soil and surface water, the following equation applies:

$$Intake = \frac{C_i \; x \; EF \; x \; F \; x \; IR \; x \; ED}{AT \; x \; BW}$$

where

Intake = Intake of chemical through ingestion of medium (mg/kg-day).

C_i = Chemical concentration in medium i (mg/kg or mg/L).

IR = Ingestion rate for medium i and receptor (kg/day or L/day).

F = Fraction of ingested medium from contaminated source (unitless).

EF, ED, BW, and AT are defined above.

Inhalation of Dust

Ambient sampling for beryllium has been conducted at numerous regional, perimeter, and on-site locations at and surrounding LANL. The measured on-site beryllium concentrations (see LANL's Environmental Surveillance Reports for 1993, 1992, 1991, and 1990) are significantly lower than the TA-14 site-specific values modeled in this analysis. This risk assessment was performed based on an EPA particulate emission factor (EPA, 1996) using TA-14 site-specific values.

For estimating respirable particulate emission from wind erosion, assuming an unlimited reservoir, the equation is (EPA, 1985):

$$E_{10} = 0.036 \; (1-V) \; (\frac{[u]}{u_t})^3 \; f(x)$$

where

E_{10} = PM_{10} emission factor (grams per square meter [g/m^2]-hour [hr]).

V = Fraction of contaminated surface vegetative cover (unitless, assumed to be 0).

[u] = Mean annual wind speed (meters [m] per second [sec], 3.2 m/sec).

u_t = The threshold value of wind speed at 7 m (m/sec).

f(x) = Function plotted in EPA, 1985 [f(x) = 1.5] where x = 0.886 u_t/[u].

Once the PM_{10} emission factor is calculated, the emission rates for the individual COPC were calculated according to the following:

$$R_{10} = \alpha \ x \ E_{10} \ x \ A \ x \ C$$

where

R_{10} = Emission rate of contaminant as PM_{10} (mg/hr).

α = Chemical concentration (mg/kg).

E_{10} = PM_{10} emission factor (g/m^2-hr).

A = Site area ([m^2], assumed to be 1000 m^2).

C = Conversion factor for kg to g.

Once the dust concentration in air has been calculated for each COPC, the chemical intake is:

$$Intake = \frac{C_i \ x \ BA \ x \ IR \ x \ ET \ x \ EF \ x \ ED}{BW \ x \ AT}$$

where

C_i = Chemical - specific air concentration (g/cubic meter [m^3]).

BA = Bioavailability factor (unitless).

IR = Inhalation rate (m^3/event, typically m^3/hr).

ET = Exposure time (hr/day).

EF, ED, BW, and AT are defined above.

Dermal Contact Soil and Sediment

The following is the chemical intake equation for dermal absorption of chemicals due to contact with soil or sediment:

$$AD = \frac{C_i \; x \; AF \; x \; ABS \; x \; CF \; x \; SA \; x \; EF \; x \; ED}{AT \; x \; BW}$$

where

AD = Absorbed dose (mg/kg-day).

C_i = Chemical concentration in medium (mg/kg).

SA = Skin surface area available for contact (square centimeters [cm^2]/event).

AF = Soil-to-skin adherence factor (mg/cm^2).

ABS = Skin absorption factor (unitless).

CF = Conversion factor (10^{-6} kg/mg).

EF = Exposure frequency (events/year).

ED, BW, and AT are defined above.

Dermal Contact with Surface Water

The following is the intake equation for dermal absorption of chemicals due to contact with surface water:

$$AD = \frac{C_i \; x \; SA \; x \; PC \; x \; CF \; x \; ET \; x \; EF \; x \; ED}{BW \; x \; AT}$$

where

AD = Absorbed dose (mg/kg-day).

C_i = Chemical concentration in surface water (mg/L).

SA = Skin surface area available for contact (cm^2).

PC = Chemical-specific dermal permeability (EPA, 1992a).

CF = Conversion factor (10^{-3} L/cm^3).

ET = Exposure time (hr/day).

EF, ED, BW, and AT are defined above.

3.1.2.2 Exposure Parameters

Three types of parameters are used in exposure models to estimate intake (EPA, 1989):

- Chemical-related parameters (e.g., exposure point concentrations),
- Parameters that describe the exposed population (e.g., contact rate, exposure frequency and duration, and body weight), and
- Toxicity-related parameters (i.e., slope factors [SF] and reference doses [RfD]).

The exposed population and exposure-related parameters are summarized in Table 3-2. The exposure parameters were taken from EPA guidance and are based on best professional judgement using site-specific information where available. Upper-bound values are generally 90th or 95th percentile values, depending on the data available for each parameter. A combination of upper-bound and average exposure parameters were used to estimate the RME for each scenario.

3.1.2.3 Intakes for Chemicals of Potential Concern

Noncarcinogenic and carcinogenic intakes of COPC at TA-14 are discussed in Section 3.3.3. Intakes are expressed in units of milligrams of individual constituent per kilogram of receptor per day.

3.2 Toxicity Assessment

Toxicity information is given in the same units provided by the source material (dose rates and concentrations are primarily used). The EPA weight-of-evidence classification (cancer class) system for carcinogenicity is presented here for reference. The classification is as follows (EPA, 1989):

- Class A—Human carcinogen,
- Class B1—Probable human carcinogen; limited human data available,
- Class B2—Probable human carcinogen; sufficient evidence in animals; inadequate or no evidence in humans,
- Class C—Possible human carcinogen,
- Class D—Not classifiable as to human carcinogenicity, and

Table 3-2
Exposure Parameters

Parameter	Value	Units	Reference/Rationale
OCCUPATIONAL INGESTION OF SOIL			
Ingestion Rate	50	mg/day	EPA, 1991a
Fraction Ingested	1	unitless	Assumes all of soil intake from site
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL DERMAL CONTACT WITH SOIL			
Adherence Factor	1.0	mg/cm^2	EPA, 1992a
Absorption Fraction	chemical specific	unitless	EPA, 1992a
Skin Surface Area	5,000	cm^2/event	EPA, 1992a
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL INHALATION OF DUST AND MODELED AIR CONCENTRATIONS			
Inhalation Rate	20	m^3/day	EPA, 1991a
Exposure Frequency	24 250	day/year	Maximum allowable time spent on site (including both detonation and burn activities) EPA, 1991a (modeled air concentrations)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL INGESTION OF SURFACE WATER			
Ingestion Rate	0.04	L/day	EPA, 1991a

Table 3-2 *(continued)*
Exposure Parameters

Parameter	Value	Units	Reference/Rationale
Fraction Ingested	1	unitless	Assumes all of soil intake from site
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989
OCCUPATIONAL DERMAL CONTACT WITH SURFACE WATER			
Dermal Permeability Constant	chemical specific	cm/hr	EPA, 1992a
Skin Surface Area	5,000	cm^2	EPA, 1992a
Exposure Frequency	24	day/year	Maximum allowable time spent on site (including both detonation and burn activities)
Exposure Duration	25	years	EPA, 1991a
Exposure Time	1	hr/day	Assumed value
Body Weight	70	kg	EPA, 1991a
Averaging Time: Carcinogens Noncarcinogens	 25,550 9,125	 days days	EPA, 1989

cm^2 = square centimeter(s)
cm/hr = centimeter(s) per hour
hr/day = hour(s) per day
kg = kilogram(s)
L = liter(s)
m^3 = cubic meter(s)
m^3/hr = cubic meter(s) per hour
mg = milligram(s)
mg/cm^2 = milligram(s) per square centimeter(s)

- Class E—Evidence of noncarcinogenicity for humans.

Slope factors are typically calculated for potential carcinogens in Classes A, B1, and B2. Quantitative estimation of slope factors for chemicals in Class C proceeds on a case-by-case basis.

For chemicals, the primary source for toxicity values, both RfD and SF, is the Integrated Risk Information System (IRIS) (EPA, 1997a). If a toxicity value for a given chemical is not available in IRIS, the secondary source is the Health Effects Assessment Summary Tables (HEAST) (EPA, 1996a). No surrogate values were developed for chemicals for which no toxicity information existed in either of the above references.

Table 3-3 summarizes the chemical toxicity information including the COPC RfD, SF, and EPA cancer classification.

Table 3-3
Human Toxicity Factors Used for
Chemicals of Potential Concern
at LANL Technical Area 14

Chemical of Potential Concern	Reference Doses[a] Oral (mg/kg-day)	Reference Doses[a] Inhalation (mg/kg-day)	Slope Factors[a] Oral $(mg/kg\text{-}day)^{-1}$	Slope Factors[a] Inhalation $(mg/kg\text{-}day)^{-1}$	Cancer Class[a]
Barium	7.00E-02	ND[b]	ND	ND	ND
Beryllium	5.00E-03	ND	4.30E+00	8.40E+00	B2
Bis(2-ethylhexyl)phthalate	2.00E-02	ND	1.40E-02	ND	B2
Cadmium	5.00E-04	ND	ND	6.30E+00	B1
Chromium	1.00E+00	ND	ND	ND	ND
HMX	5.00E-02	ND	NA[c]	NA	D
Lead	ND	ND	ND	ND	B2
RDX	3.00E-03	ND	1.10E-01	ND	C
Tetryl	ND	ND	ND	ND	ND
TNT	5.00E-04	ND	3.00E-02	ND	C

[a]All toxicity values from Integrated Risk Information System (IRIS) (EPA 1997a).
[b]ND = No data available to establish toxicity factor.
[c]NA = Not considered to be carcinogenic to humans (EPA 1997a).

3.3 Risk Characterization

This section provides a characterization of the potential health risks associated with the intake of chemicals at TA-14. Risk characterization compares estimated potential cancer risks with reasonable levels of risk for carcinogens and compares estimated daily intake (rate) with reference levels for noncarcinogens. Carcinogens may also pose a systemic (noncarcinogenic) hazard, and these potential hazards are characterized in the same manner as other noncarcinogens.

Estimation of potential risk from exposure to the site contaminants is based on RAGS (EPA, 1989). This assessment employs a health-protective bias that leads to the overestimation of risk. Individuals are exposed to an RME (see Section 3.1.1) and exposure is evaluated (see Section 3.1.2) to provide estimates of daily intakes. These estimated intakes (rates) are combined with the individual chemical toxicological values (see Section 3.2) to determine the potential carcinogenic risks and the potential systemic impacts on human health.

3.3.1 Estimation of Carcinogenic Risk

In weighing occupational exposure to potentially carcinogenic compounds, a reasonable level of risk must be selected. The EPA used an incremental lifetime cancer risk (ILCR) (also referred to as excess cancer risk) of one in one million (1×10^{-6}) as the lower bound of an acceptable range for developing drinking water standards. The upper bound of an acceptable ILCR recommended by the EPA for drinking water is 1 in 10,000 (1×10^{-4}) (EPA, 1987). In addition, the EPA specifies a risk range of 10^{-6} to 10^{-4} associated with the consideration and selection of remedial alternatives for contaminated land in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (EPA, 1990).

Based on the regulatory precedents cited above, a reasonable and appropriate ILCR range would be from 10^{-6} to 10^{-4}. As implemented under the NCP, pathway ILCR greater than 10^{-6} must receive risk management consideration (EPA, 1990). The quantitative risk assessment is one of many factors that is considered in the decision-making process for remediation. Therefore, there is no single risk value that defines "acceptable" and "unacceptable" risk. The purpose of this risk assessment is to present quantitative and qualitative estimates of potential risk; thus, all pathway risk greater than the lower bound of 10^{-6} will be examined.

For TA-14, cumulative site ILCRs were developed. These cumulative ILCRs included all media and pathways that were appropriate to combine. Cumulative ILCRs occur when there is potential for an individual to be exposed to multiple pathways at the same given instant in time. Where the cumulative site ILCR to an individual based on the RME for both current and future land use is less than 10^{-4}, action is generally not warranted unless there are adverse environmental impacts (EPA, 1991b).

Carcinogenic risk is estimated as the probability of an additional incidence of cancer above background. This risk is:

$$ILCR = SF \times Intake$$

where

ILCR = ILCR (unitless).

SF = Carcinogenic SF [(mg/kg-day)$^{-1}$].

Intake = Chronic daily intake averaged over a 70-year lifetime (mg/kg-day).

The carcinogenic SFs for the COPC are presented in Table 3-3.

For a given pathway and medium with exposure to several carcinogens, the following equation was used to sum the cancer risk:

$$Risk_{t,p} = \sum_{i=1}^{I} ILCR_p\ (chem_i)$$

where

$Risk_{t,p}$ = Total cancer risk for pathway p (unitless).

$ILCR_p(chem_i)$ = Individual cancer risk for constituent i through exposure pathway p (unitless).

Estimates of ILCRs for each exposure pathway are addressed in Section 3.3.3.

3.3.2 Estimation of Noncarcinogenic Risk

Chemicals that pose a health threat other than cancer were evaluated by comparing an exposure level or intake to an acceptable level or RfD. The ratio of estimated daily intake to the RfD is termed the hazard quotient (HQ) and is defined as:

$$HQ_{i,p} = \frac{I_{i,p}}{RfD_i}$$

where

$HQ_{i,p}$ = Individual HQ for exposure to constituent i through exposure pathway p (unitless).

$I_{i,p}$ = Daily intake via a specific pathway p for constituent i (mg/kg-day).

RfD_i = RfD for exposure by the specific pathway (limited to oral and inhalation values) for constituent i (mg/kg-day).

The RfD is an estimate of the intake level to which a human population, including sensitive subpopulations, may be chronically exposed without a significant risk of adverse health effects (EPA, 1989). The RfDs for the COPC at TA-14 are listed in Table 3-3. Because the HQ does not define intake response relationships, its numerical value should not be construed as a direct estimate of risk, but it does suggest that a given situation should be more closely scrutinized. The concept of the HQ implies the existence of a threshold for systemic health effects. It is a numerical indication of the fraction of acceptable limits of exposure or the degree to which acceptable exposure levels are exceeded. As this quotient increases toward unity, concern for the potential hazard of the constituent increases. A value above unity is an indication of risk, although a direct correlation to the magnitude of the risk cannot be drawn.

In the case of simultaneous exposure to several chemicals, the hazard index (HI) is calculated to evaluate the potential risk from exposure to the mixture by summing the HQs for each chemical, media, and pathway. The total HI incorporates the assumption of additive effects when dealing with a mixture of components. The HI formula is as follows (EPA, 1989):

$$HI = \sum_{i=1}^{I} HQ_i$$

where

HI = Hazard index (unitless).

HQ_i = Hazard quotient for exposure to constituent i (unitless).

Summation of the individual HQs could result in an HI that exceeds 1, even if no single chemical exceeds its acceptable level. Mechanistically, it is not appropriate to sum HQs unless the constituents that make up the mixture have similar modes of action on an identical organ. Consequently, the summing of HQs for a mixture of compounds that is not expected to include the same type of effects could overestimate the potential risk. The EPA recommends that if the total HI is greater than unity, the components of the mixture should be grouped by critical effect, and separate hazard indices should be calculated for each effect.

Estimates of noncarcinogenic risks for each occupational exposure pathway are provided in the following section.

3.3.3 Results of the Human Health Risk Characterization

Tables 3-4 and 3-5 summarize the risks for each exposure pathway at TA-14. Included in this summary are the carcinogenic and noncarcinogenic intakes; ILCR and HQ for each COPC and pathway; and pathway total ILCR and HI.

The human health risk assessment suggests that the current level of contamination, for both surface soil and surface water, does not pose a potential significant risk to human health. None of the individual COPC for any of the pathways considered had an ILCR above 1×10^{-6} or an HQ above 1.0. The current and future cumulative site ILCR to an occupational receptor based on the RME is 6.3×10^{-7}, well below 1×10^{-4}. Therefore, under current and anticipated future conditions, exposure to COPC at TA-14 as a whole poses no potential significant carcinogenic risk (EPA, 1991b).

Table 3-4
Estimated Daily Intakes and Incremental Lifetime Cancer Risks (ILCR) for LANL Technical Area 14

Potentially Exposed Population	Exposure Pathway	Chemical	Estimated Intake (mg/kg-day)	ILCR
Occupational	Incidental Ingestion of Soil	Beryllium Bis(2-ethylhexyl)phthalate RDX TNT Total	5.8E-08 5.5E-09 2.3E-08 4.4E-07	2.5E-07 7.7E-11 2.5E-09 1.3E-08 2.6E-07
Occupational	Dermal Contact with Soil	Beryllium Bis(2-ethylhexyl)phthalate RDX TNT Total	5.8E-08 8.3E-08 2.3E-08 4.4E-07	2.5E-07 1.2E-09 2.5E-09 1.3E-08 2.7E-07
Occupational	Inhalation of Fugitive Dust	Beryllium Cadmium Total	6.8E-11 2.2E-11	5.7E-10 1.4E-10 7.1E-10
Occupational	Incidental Ingestion of Surface Water	Beryllium	2.0E-08	8.7E-08
Occupational	Dermal Contact with Surface Water	Beryllium	2.4E-09	1.0E-08
Occupational	Inhalation of Air (modeled)	No carcinogenic chemicals of potential concern		

Table 3-5
Estimated Daily Intakes and Hazard Quotients (HQ) for LANL Technical Area 14

Potentially Exposed Population	Exposure Pathway	Chemical	Estimated Intake (mg/kg-day)	HQ
Occupational	Incidental Ingestion of Soil	Beryllium	1.6E-07	3.2E-05
		Bis(2-ethylhexyl)phthalate	1.5E-08	7.7E-07
		Cadmium	5.2E-08	1.0E-04
		HMX	1.4E-05	[illegible]-04
		RDX	6.4E-08	[illegible]-05
		TNT	1.2E-06	2.5E-03
		Total		2.9E-03
Occupational	Dermal Contact with Soil	Beryllium	1.6E-07	3.2E-05
		Bis(2-ethylhexyl)phthalate	2.3E-07	1.2E-05
		Cadmium	5.2E-09	1.0E-05
		HMX	1.4E-05	2.7E-04
		RDX	6.4E-08	2.1E-05
		TNT	1.2E-06	2.5E-03
		Total		2.8E-03
Occupational	Inhalation of Fugitive Dust	No noncarcinogenic chemicals of potential concern		
Occupational	Incidental Ingestion of Surface Water	Barium	3.4E-06	4.9E-05
		Beryllium	5.7E-08	1.1E-05
		Cadmium	5.5E-08	1.1E-04
		Chromium	1.8E-07	1.8E-07
		Total		1.7E-04
Occupational	Dermal Contact with Surface Water	Barium	4.1E-07	5.8E-06
		Beryllium	6.8E-09	1.4E-06
		Cadmium	6.6E-09	1.3E-05
		Chromium	2.2E-08	2.2E-08
		Total		2.0E-05
Occupational	Inhalation of Air (modeled)	No noncarcinogenic chemicals of potential concern		

3.3.4 General Uncertainties

The overriding uncertainties associated with the risk characterization are as follows:

- The extrapolation of toxic effects observed at the high doses necessary to conduct animal studies to effects that might occur at much lower, more realistic doses.

- The extrapolation from toxic effects in laboratory animals to toxic effects in humans (i.e., responses of animals may be different from responses of humans).

- Pathway analyses have been conservative and generally do not include fate and transport considerations (such as dispersion or adsorption) in the estimates.

Extrapolations from laboratory animal studies form the basis for the derivation of factors used to estimate risks. Uncertainties are taken into account when deriving RfDs and SFs. The risk assessment utilized EPA guidance in minimizing the uncertainties through the use of published standards and criteria to evaluate risks posed by chemicals measured at TA-14.

In addition to the general uncertainties listed above, the sources of uncertainty in characterizing risk at TA-14 include the following:

- Risk due to lead was not quantified. However, the maximum detected lead concentration in surface soil was 79 mg/kg. Most occupational preliminary remediation goals for lead are set at 1,000 mg/kg or higher (CEPA, 1996; EPA, 1996). Therefore, lead is not of concern at TA-14.

Risk assessment is ultimately an integrated evaluation of historical, chemical, analytical, environmental, demographic, and toxicological data that are as site-specific as possible. To safeguard against the effects of uncertainty in the evaluation, each step is biased toward health protective estimations. Because each step builds on the previous one, this biased approach should more than compensate for risk assessment uncertainties. In addition, the calculations presented in this risk assessment do not necessarily accurately represent currently existing or expected future exposure or health risks. Rather, they are estimates of potential risk only if all the conservative assumptions are realized.

4.0 Ecological Risk Assessment

As mentioned earlier, the ecological risk assessment for TA-14 is a screening level assessment. A screening level assessment is defined here as a preliminary evaluation of potential ecological risks that incorporates limited site-specific data, conservative exposure assumptions, literature-obtained transfer factors, and literature-obtained or -derived ecotoxicological benchmark values. It is used as an evaluation tool to determine what chemicals in the environment may present risk and establishes a basis for the collection of additional site-specific data should risks be predicted. This assessment follows the generally accepted tiered approach as recommended by EPA (EPA, 1992c; 1996b; and 1997b). A discussion of the site, fate and transport characteristics, and COPC were discussed in previous sections of this document. This section briefly re-addresses components of the problem formulation phase of the ecological risk assessment that were presented in earlier sections of this document. It also includes the analysis and risk characterization components of the risk assessment process.

4.1 Problem Formulation

Problem formulation is the first step of an ecological risk assessment process. It can be defined as a systematic planning step that identifies the major factors to be considered in a particular assessment (EPA, 1992c). In short, it establishes the goals, breadth, and focus of the assessment and is linked to the regulatory and policy context of the assessment. The problem formulation process begins with the initial stages of characterization exposure and ecological effects expected and observed. It describes the relationships among assessment and measurement endpoints, data required, and methodology that will be used to analyze the data. This section specifically addresses the ecology of the site (Section 4.1.1), the conceptual model (Section 4.1.2), the assessment and measurement endpoints used in the evaluation process (Section 4.1.3), and the chemicals of potential ecological concern (Section 4.1.4).

4.1.1 Ecological Description

The open burning/open detonation (OB/OD) units at TA-14 are located near the south rim of Three-Mile Mesa and bounded by Cañon de Valle and Three-Mile Canyon. The following information is based on LANL's Biological Resource Evaluations Teams' draft "Biological and Floodplain/Wetlands Assessment for Environmental Restoration Program Operable Unit 1085, TAs 14 and 67" (LANL, 1995). The elevation of the mesatop at the site is approximately 7,400 feet. The soils in this area consist primarily of Carjo loam, Pogna fine sandy loam, and Frijoles very fine sandy loam. Steep rock outcrops characterize the canyon wall south of the site, which descends about 300 feet into Cañon de Valle. The drainage in Cañon de Valle is ephemeral, flowing southeast to Water Canyon, about 1 mile downstream, which in turn flows into the Rio Grande, about 8 miles further downstream.

The vegetation on Three-Mile Mesa is woodland, dominated by ponderosa pine (*Pinus ponderosa*), piñon pine (*Pinus edulis*), and one-seed juniper (*Juniperus monosperma*). The dominant shrubs in this habitat include oaks (*Quercus* spp.), mountain mahogany (*Cercocarpus montanus*), Apache plume (*Fallugia paradoxa*), and squawbush (*Rhus trilobata*). Herbaceous understory plants include mountain muhly (*Muhlenbergia montana*), blue grama (*Bouteloua gracilis*), little bluestem (*Andropogon scoparius*), bitterweed (*Hymenoxys richardsonii*), and wormwood (*Artemisia carruthii*). On the south-facing canyon wall and in the bottom of Cañon de Valle, the vegetation is dominated by ponderosa pine and one-seed juniper, with Gambel oak (*Quercus gambelii*) also becoming an important overstory species. Shrubs include New Mexico locust (*Robinia neomexicana*), cliffbush (*Jamesia americana*), mountain mahogany, and hybrid oaks (probably hybrids between Gambel oak and wavyleaf oak [*Quercus undulata*]). Herbaceous understory plants include mountain muhly, bluegrass (*Poa* spp.), little bluestem, big bluestem (*Andropogon gerardii*), and wormwood.

Eighty-two species of birds are either known or expected to occur in the area, of which 42 are known to breed in TA-14 or TA-67. These include the American kestrel (*Falco sparverius*), great horned owl (*Bubo virginianus*), western wood pewee (*Contopus sordidulus*), common raven (*Corvus corax*), scrub jay (*Amphelocoma coerulescens*), American robin (*Turdus migritorius*), yellow-rumped warbler (*Dendroica coronata*), rufous-sided towhee (*Pipilo eurythrophthalamus*), and chipping sparrow (*Spizella passerina*). Mammalian wildlife species include mice (*Peromyscus* and *Reithrodontomys* spp.), voles (*Microtus* spp.), woodrats (*Neotoma* spp.), chipmunks (*Eutamias* spp.), Abert's squirrel (*Sciurus aberti*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), bobcat (*Felis rufus*), black bear (*Ursus americanus*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*).

No threatened, endangered, or sensitive (TES) plant species are known or expected to occur in TA-14. NMED requested that LANL consider the potential exposure of nine TES wildlife species in the evaluation for the TA-14 NOD response. These include the Jemez Mountains salamander (*Plethodon neomexicanus*), bald eagle (*Haliaeetus leucocephalus*), American peregrine falcon (*Falco peregrinus anatum*), whooping crane (*Grus americana*), Mexican spotted owl (*Strix occidentalis lucida*), broad-billed hummingbird (*Cynanthus latirostris*), southwestern willow flycatcher (*Empidonax traillii extimus*), gray vireo (*Vireo vicinior*), and meadow jumping mouse (*Zapus hudsonius luteus*). The following accounts describe the potential for each of these to occur at or be influenced by hazardous waste treatment operations at the TA-14 OB/OD units.

Jemez Mountains salamander. The Jemez Mountains salamander has been recorded in several canyons that cross LANL boundaries. The species occurs in moist locations, such as rotting logs, and especially on north-facing slopes with slopes greater than 37 percent. It has been recorded at elevations ranging from over 10,000 feet down to 7,180 feet (in Los Alamos Canyon). In Cañon de Valle, the Jemez Mountains salamander has been found at an elevation of 8,101 feet. Thus, the OB/OD units are situated at the lower extreme of the known elevation range of this species and nearly 700 feet below its known occurrence in Cañon de Valle. Because the slopes below this site are south-facing, it is highly unlikely that the moist micohabitat conditions necessary for this species exist on these slopes. Therefore, due to the absence of favorable habitat conditions, it is unlikely that this species will be affected by operations at the OB/OD units.

Bald eagle. Bald eagles migrate and winter along the Rio Grande, roosting in White Rock Canyon and hunting on Cochiti Reservoir, as far upstream as Alamo Canyon. Storm water runoff from the area of the OB/OD units is hydrologically connected to this part of the Rio Grande through Cañon de Valle and Water Canyon, over a distance of about 9 miles, making possible a pathway for chemicals from this site to enter the food chain for this species. However, the large degree of dilution occurring along the path to the Rio Grande coupled with dilution within the reservoir itself would make this exposure pathway insignificant.

American peregrine falcon. American peregrine falcon nesting habitat (cliffs) has been identified in Los Alamos County, north of LANL. The species has been observed on occasion in the area of LANL, but no nests have been recorded there. Lower Water and Ancho Canyons are marginally suitable for falcons, but no observations of the species have been made in the area of TA-14. Therefore, the potential for exposure to this species by chemical constituents at the OB/OD units is very low.

Whooping crane. Whooping cranes migrate with sandhill cranes along the Rio Grande going to and from their wintering areas in central New Mexico (e.g., the Bosque del Apache National Wildlife Refuge) and other locations farther south. They use open fields and shallow bodies of water for feeding and resting during migration. Migratory flights between these locations tend to be at high altitudes for extended distances. Because open habitats favorable to this species do not occur at LANL, it is not expected that this species will occur within LANL boundaries except possibly as a fly-over. Thus, the potential for exposure of this species as a result of thermal treatment operations at the TA-14 OB/OD units is very low.

Mexican spotted owl. The Mexican spotted owl has been documented at LANL, and nesting and roosting habitat for this species has been identified along Cañon de Valle, adjacent to TA-14 (LANL, 1997). Therefore, the potential exists for this species to occur at or near the OB/OD units. This species was used in the evaluation of ecological pathways.

Broad-billed hummingbird. The broad-billed hummingbird nests in arid scrublands of southern New Mexico and occurs as far north as LANL as a vagrant. Thermal conditions limit the northern extent of successful breeding in this species. Therefore, its potential for occurrence at or near the OB/OD units is low, and the possibility of it nesting in the area is very remote. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is low.

Southwestern willow flycatcher. The southwestern willow flycatcher is known to occur in the Jemez Mountains, but breeding has not been confirmed there. Willow flycatchers nest in wooded riparian areas, particularly in willow-cottonwood associations. This species has been detected on LANL property. Although potential habitat exists for this species in Pajarito Canyon, it is unlikely to occur at or near the TA-14 OB/OD units due to the lack of favorable habitat in Cañon de Valle. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

Gray vireo. The gray vireo nests in piñon-juniper woodlands throughout much of central New Mexico, occasionally being as far north as Santa Fe. It has not been recorded in the area of TA-14. Consequently, the potential for exposure of this species to hazardous constituents resulting from thermal treatment operations at the TA-14 OB/OD units is very low.

Meadow jumping mouse. The meadow jumping mouse is typically found in dense, tall, grassy vegetation, especially near streams, meadows, and other wetlands. The species occurs at higher elevations and populations have been found along the Rio Grande in the central part of the New Mexico. It has not been recorded in Los Alamos County and species-specific surveys at LANL have failed to document it in areas of favorable habitat. Because favorable habitat for this species does not occur at or near the OB/OD units at TA-14, it is highly unlikely that this species will be affected by thermal treatment operations at the site.

4.1.2. Conceptual Model

The conceptual model for the TA-14 ecological risk assessment is presented in Figure 3-1. Exposure is believed to be of greater significance to terrestrial receptors than to aquatic receptors due to the temporary nature of the ephemeral drainage. The woodland habitat is characterized in greater detail than the ephemeral drainage because the drainage does not support semi-aquatic wildlife.

4.1.3 Endpoints

Endpoints for the TA-14 ecological risk assessment have been selected to be protective of the specific ecosystems and receptors associated with the area. Emphasis is placed on the two habitat types associated with TA-14: the woodland habitats and ephemeral drainage that leads to Cañon de Valle (this drainage collects runoff from TA-14). Table 4-1 presents the management goals, assessment endpoints, and measurement endpoints associated with these two habitat types. Because the ephemeral drainage is very temporary in nature, it does not support semi-aquatic wildlife species that would normally utilize riparian systems. In addition, because no sediment data exist for the drainage, only surface water data will be used to gauge habitat quality.

4.1.4 Chemicals of Potential Ecological Concern

The identification of COPC is presented in Section 2.0. Because the process used in the selection of COPC for this risk assessment is not risk-based and only involves comparison to background concentrations, all COPC identified in the human health risk assessment will also be utilized as chemicals of potential ecological concern (COPEC). All COPEC are presented in Tables 2-1 through 2-3. Because no surface water background data were available, all chemicals detected in surface water were considered COPEC.

Table 4-1
Endpoints for the LANL Technical Area 14 Ecological Risk Assessment

Management Goal	Assessment Endpoint	Measurement Endpoint
• Protection of the natural plant and animal diversity of the woodland ecosystems of TA-14	• Toxicity of soil to plants	• Comparison of soil chemistry data with phytotoxicity benchmark values
	• Toxicity of soil to terrestrial wildlife	• Quotient Method
• Protection of the aquatic ecosystems associated with the ephemeral drainage	• Toxicity of surface water to freshwater biota	• Comparison of surface water chemistry to water quality criteria • Percentage of total area of equivalent habitat impacted

4.2 Analysis

By definition, the analysis phase "consists of the technical evaluation of data to reach conclusions about ecological exposure and the relationships between the stressor and ecological effects" (EPA, 1996b). This phase follows the problem formulation phase of the ecological risk assessment, addresses exposure, and presents toxicity information. The products of the analysis phase will feed directly into the risk characterization segment.

4.2.1 Exposure Assessment

The exposure assessment examines the exposure pathways, ecological receptors, and methods used to quantify exposure. As discussed in Section 4.2.1, exposure to the selected receptors is only quantitatively estimated if a complete exposure pathway exists.

4.2.2 Exposure Pathways

As presented in Figure 3-1, ecological receptors can be exposed directly to soil contaminants associated with TA-14. Exposure can also occur through food chain interactions. Runoff from the site can also result in potential exposure of surface water and sediment biota to COPEC from TA-14 soils. The most significant exposure pathways for terrestrial receptors are direct uptake by plants and ingestion by wildlife. Direct uptake of COPEC from soil was assumed to be the major route of exposure of plants to COPEC, with exposure of plants to wind-blown soil assumed to be minor. In this assessment, COPEC in soil are considered bioavailable to a depth of 5 feet. This is supported by information on root depths (Reynolds and Wakkinen, 1987; Reynolds and Fraley, 1989). Exposure modeling for the wildlife receptors was limited to the food ingestion pathway. Inhalation and dermal contact were considered insignificant pathways relative to ingestion (Sample and Suter, 1994). Exposures for this screening-level assessment were modeled using an area use factor of 1, implying that all food items and soil ingested are from the site being investigated. Drinking water was also considered an insignificant pathway because of the lack of permanent surface water at this site. The potential exists for surface water biota to be exposed to runoff that collects within the drainage of Cañon de Valle. Consequently, surface water biota in this assessment were considered exposed to COPEC in surface water.

4.2.3 Ecological Receptors

Plants and wildlife were selected as indicators of potential risk to the terrestrial environment. A non-specific perennial plant was used as the receptor to represent plant species at the site. The wildlife receptor species used to evaluate potential ecological risk at the TA-14 OB/OD units were selected to represent the range of trophic levels that comprise the food web in the woodland habitats of this site, including herbivores, insectivorous, omnivorous, and predators. In general, smaller species within each of these groups were used to model food chain transfers and exposures because they are likely to have smaller home ranges and, therefore, higher exposures to soil contaminants. Preference was generally given to species identified as occurring in TA-14 (based on species lists in LANL, 1995), although TES status was also considered. As discussed previously, nine wildlife species were evaluated for their potential presence at or near the OB/OD site. Of these, only the Mexican spotted owl was identified as being likely to occur in TA-14. This species was therefore selected as the large predator in the representative food web. The other selected receptors are the vagrant shrew (*Sorex vagrans*), western harvest mouse (*Reithrodontomys megalotis*), montane vole (*Microtus montanus*), American kestrel, and the gray fox. Table 4-2 presents the species-specific parameters used to model exposures in each of these receptors.

Although the other eight TES listed by NMED have not been included directly in this assessment due to their low probability of occurrence, the selected receptors will act as surrogate receptors for many of them. For example, the western harvest mouse, a small omnivorous rodent, will act as a surrogate for the larger meadow jumping mouse. The American kestrel is modeled as an insectivorous bird, thereby representing potential risks to other insectivorous birds, which would include the gray vireo or southwestern willow flycatcher if they were to be present at the site. The exposure to the American kestrel as a result of feeding at the site is also expected to be greater than that of a peregrine falcon feeding in the area because of the smaller ranges of both the kestrel and its prey.

With respect to the ephemeral drainage, only surface water biota were considered as potential ecological receptors. No specific taxa were selected to represent these biota. This is because ambient water quality criteria for the protection of freshwater aquatic life were used as toxicological benchmarks and are based on the most sensitive study species.

4.2.4 Exposure Estimation

Because site-specific biological monitoring data were not available for TA-14, exposure concentrations were estimated through the use of models. The maximum measured or the 95 percent UCL COPEC concentrations (whichever was lower) from soil and surface water data were used to conservatively estimate potential exposures and risks to plants and wildlife at this site and to aquatic biota that may be associated with the Cañon de Valle drainage. Table 4-3 presents the transfer factors used in modeling the concentrations of COPEC through the food chain.

Table 4-2
Data Used to Model Exposure in the Terrestrial Wildlife Species
LANL Technical Area 14

Indicator Species	Class/Order	Body Weight[a] (kg)	Dietary Intake[b] (kg[dw]/day)	Trophic Level	Dietary Composition[c] (percent)	
Vagrant shrew (*Sorex vagrans*)	Mammalia/ Insectivore	0.0046	0.00111	Insectivore	Soil: 13 Insect: 100	
Western harvest mouse (*Reithrodontomys megalotis*)	Mammalia/ Rodent	0.0104	0.00233	Omnivore	Soil: 2 Plants: 50	Insects: 50
Montane vole (*Microtus montanus*)	Mammalia/ Rodent	0.0291	0.00416	Herbivore	Soil: [illegible] Plants: 100	
Gray fox (*Urocyon cinereoargenteus*)	Mammalia/ Carnivore	2.5	0.146	Omnivore	Soil: 2.8 Plants: 13 Insects: 7	Mice: 40 Voles: 40
American kestrel (*Falco sparverius*)	Aves/ Falconiform	0.111	0.0218	Insectivore	Soil: 2 Insects: 100	
Mexican spotted owl (*Strix occidentalis*)	Aves/ Strigiform	0.518	0.0379	Carnivore	Soil: 2 Shrews: 25	Mice: 50 Voles: 25

[a]From Silva and Downing (1995) for mammals, and Dunning (1993) for birds.
[b]From the allometric equations in Nagy (1987).
[c]Based on data in EPA (1993), and Martin et al. (1951).

Table 4-3
Transfer Factors Used in Exposure Models for LANL Technical Area 14 Ecological Risk Assessment

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Barium	1.50×10^{-1} [a]	1.00×10^{0} [b]	2.00×10^{-4} [c]
Beryllium	1.00×10^{-2} [a]	1.00×10^{0} [b]	2.00×10^{-3} [c]
Cadmium	5.50×10^{-1} [a]	6.00×10^{-1} [d]	5.50×10^{-4} [a]
Lead	9.00×10^{-2} [c]	4.00×10^{-2} [d]	8.00×10^{-4} [c]
Bis(2-ethylhexyl)phthalate	5.78×10^{-2} [e]	2.31×10^{1} [f]	2.07×10^{-3} [e]
2,4,6-trinitrotoluene	4.60×10^{0} [e]	1.58×10^{1} [f]	8.28×10^{-7} [e]
RDX	1.22×10^{1} [e]	1.45×10^{1} [f]	1.46×10^{-7} [e]
HMX	2.74×10^{1} [e]	1.36×10^{1} [f]	3.42×10^{-8} [e]
Tetryl	4.31×10^{0} [e]	1.59×10^{1} [f]	9.32×10^{-7} [e]

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (1989).
[d]From Stafford et al. (1991).
[e]From equations developed in Travis and Arms (1988).
[f]From equations developed in Connell and Markwell (1990)

4.2.4.1 Terrestrial Receptors

Exposures to COPEC in the indicator wildlife species are estimated from maximum soil concentrations using the methods described in the EPA's "Wildlife Exposure Factors Handbook" (EPA, 1993). In the screening assessment, only the dietary exposure pathway is considered. The inhalation and dermal contact pathways are not considered to be significant pathways for COPEC in the soil. Although both of these pathways may lead to additional absorption of the COPEC, both are also linked to ingestion by the ingestion of soil particles that have been entrapped in the mucus lining of the nasal cavity and throat and the ingestion of soil through grooming. The absorption of COPEC from soil particles directly through the lungs or skin is expected to be insignificant with respect to that from the daily dietary intake of soil.

The drinking water ingestion pathway is also expected to be minor. Surface water in this area is ephemeral and extremely limited, allowing little opportunity for COPEC to accumulate in the water. Ephemeral surface water may exist as runoff from precipitation events.

The basic equation for estimating dose through the dietary pathway is:

$$D_p = \sum_{k=1}^{m} (C_k \cdot F_k \cdot I_k)/W$$

where:

D_p = the potential average daily dose (mg/kg-day).

C_k = the average COPEC concentration in the k^{th} food type (mg/kg dry weight).

F_k = the fraction of the k^{th} food type that is contaminated.

I_k = the ingestion rate of the k^{th} food type (kg dry weight/day).

W = the body weight of the receptor (kg wet weight).

Natural history data used in modeling the exposure in each of the wildlife receptor species include the average or midpoint body weight, the total ingestion rate, and the fraction of the diet composed of various food types. For screening purposes, the calculation of C_k is based on the maximum modeled soil concentration. The food items of a particular type are considered to be equally contaminated throughout the entire home range of the receptor; therefore, F_k is 1.

Estimates of the concentrations of COPEC in terrestrial plants were made using the chemical-specific concentration in soil from TA-14. Soil-to-plant transfer factors for inorganics were obtained from a variety of sources which include IAEA (1994), NCRP (1989), and Baes et al. (1984). Transfer coefficients for organic COPEC were estimated using the equation derived by Travis and Arms (1988), which is based on the linear regression of the log K_{ow} for 29 organic compounds ranging from 1.15 to 9.35 and analytically derived soil-to-plant bioconcentration factors. Concentrations in above-ground plant parts were estimated using the following equation from Baes et al. (1984):

$$C_v = (C_s)(B_v)$$

where:

C_v	=	the concentration of the COPEC in vegetation (mg/kg, dry weight).
C_s	=	the concentration of the COPEC in soil (mg/kg, dry weight).
B_v	=	the soil-to-plant transfer factor (unitless).

The average COPEC concentration in ingested soil is taken to be the 95 percent UCL or the maximum measured soil concentration, whichever is lower. For soil insects, soil-to-organism transfer factors were used to estimate the COPEC concentrations in their tissues on a dry weight basis. For organic COPECs in soil insects, the transfer factor was derived from the equation developed by Connell and Markwell (1990) for bioaccumulation in earthworms:

$$BF = \frac{y_L \cdot K_{ow}^{b-a}}{x \cdot f_{oc}}$$

where:

BF	=	the bioaccumulation factor (unitless).
y_L	=	the fractional lipid content of the organism.
K_{ow}	=	the octanol/water partition coefficient.

(b-a) = a nonlinearity constant.

x = a proportionality constant.

f_{oc} = the fractional organic carbon content in the soil.

Although derived from earthworm data, the values for the nonlinearity constant (0.05) and proportionality constant (0.66) were applied to modeling uptake in soil insects. Because of differences in integument, it is expected that the uptake by earthworms will generally be greater than that of insects. Therefore, these factors are expected to yield conservative estimates of insect uptake. The lipid content in insects was estimated at 3.1 percent fresh weight (Taylor, 1975), which is 7.9 percent of dry weight, using a value of 61 percent water content in beetles (EPA, 1993). Based on the method described in Brady (1974), the fraction of organic carbon in the soil was estimated by dividing the organic matter content by the value 1.7. The average organic matter content of 21 Southern Great Plains soils (1.55 percent) (Brady, 1974) was used to estimate the organic matter content in TA-14 soils. Except where literature-derived values are available, the soil-to-insect transfer factors for inorganics were assumed to be 1.

Tissue concentrations in vertebrate prey species were estimated from the daily intake of the COPEC through the use of transfer factors for beef. The regression equation developed by Travis and Arms (1988) and based on the log K_{ow} value of the chemical of concern was used to derive food-to-beef transfer factors for the organic COPEC. Transfer factors for the inorganic COPEC were taken from IAEA (1994), NCRP (1989), and Baes et al. (1984). A weighted average of the concentrations of all food items (including ingested soil) was then used in the calculation of tissue concentrations in prey species and the dietary exposure rate in all indicator species.

4.2.4.2 Aquatic Receptors

For this assessment, aquatic macroinvertebrates were exposed to COPEC in surface water. Because risk was elevated by direct comparison of surface water concentrations to water quality criteria, it was not necessary to utilize exposure models.

4.2.5 Effects Characterization

The second major component of the analysis phase is to obtain information on the toxicity of the specific COPEC to the ecological receptors. Toxicity information is compiled into a form that makes it comparable to either soil or surface water concentrations or to intake values. These values are referred to as benchmark screening values.

4.2.5.1 Plants

General information on the chronic toxicity of inorganic and organic compounds to vascular plants was primarily obtained from Will and Suter (1995). These benchmark values are based on lowest-observed-adverse-effect-levels (LOAEL) and are presented in Table 4-4.

4.2.5.2 Wildlife

No-observed-adverse-effect-levels (NOAEL) for chronic oral exposure were used as benchmarks for toxic effects to wildlife (Table 4-4). Because the NOAELs for the indicator wildlife species are based on NOAELs from test species, the latter were converted to NOAELs specific to indicator species using a power function of the ratio of body weights, as described by Sample et al. (1996). Thus:

$$NOAELw = NOAEL_T \left(\frac{BW_T}{BW_W}\right)^s$$

where:

$NOAEL_W$	=	the no-observed-adverse-effect-level for the wildlife indicator species (mg/kg-day).
$NOAEL_T$	=	the no-observed-adverse-effect-level for the test species (mg/kg-day).
BW_T	=	the body weight of the test species (kg).
BW_W	=	the body weight of the wildlife indicator species (kg).
s	=	a body weight scaling factor (s = 1/4 for mammals and s = 0 for birds).

Table 4-4
Toxicity Data for Ecological Receptors at LANL Technical Area 14

		Mammalian NOAELs		Avian NOAELs	
Constituent of Potential Ecological Concern	**Plant Benchmark[a]**	**Mammalian Test Species[b]**	**Test Species NOAEL[c]**	**Avian Test Species[d]**	**Test Species NOAEL[d]**
Barium	500	Lab rat[e]	5.1	Chicks	20.8
Beryllium	3	Lab rat	0.66	---[f]	---
Cadmium	3	Lab rat[g]	1	Mallard	1.45
Lead	50	Lab rat	8	American kestrel	3.85
Bis(2-ethylhexyl)phthalate	---	Lab rat	1771	---	---
2,4,6-trinitrotoluene	30	Lab rat[h]	1.6[i]	---	---
RDX	100	Lab rat[h]	0.3[h]	---	---
HMX	---	Lab rat[j]	10[i]	---	---
Tetryl	25	Lab rat[j]	13[k]	---	---

[a]From Will and Suter (1995).
[b]From Sample et al. (1996), except where noted. The body weight (in kilograms) for NOAEL conversion for the lab rat is 0.350 (except where noted).
[c]From Sample et al. (1996), except where noted.
[d]From Sample et al. (1996).
[e]Body weight of 0.435 kg was used for NOAEL conversion (Sample et al. 1996).
[f]--- designates insufficient toxicity data.
[g]Body weight of 0.303 kg was used for NOAEL conversion (Sample et al. 1996).
[h]From EPA (1997).
[i]From Ryan (1987).
[j]Estimated using LD_{50} information specific to the compound (e.g., RTECS, 1997), and NOAEL information for TNT as described in Sample et al. (1996).
[k]From Talmage et al. (1996).

When only subchronic oral $NOAEL_T$ values were available, these where converted to chronic $NOAEL_T$ values by applying an uncertainty factor of 0.2 (Sample et al., 1996). Similarly, when only chronic LOAELs were available for test species, an uncertainty factor of 0.2 was used to convert it to the $NOAEL_T$. In cases where only an acute toxicity value was available for a specific COPEC (e.g., a lethal dose to 50 percent of the test population [LD_{50}]) but both a NOAEL and LD_{50} value were available for a closely related compound in the same test species, the $NOAEL_T$ for the COPEC was estimated using the relationship from Sample et al. (1996):

$$NOAEL_{TX} = LD_{50TX}\left(\frac{NOAEL_{TY}}{LD_{50TY}}\right)$$

where,

$NOAEL_{TX}$	=	the no-observed-adverse-effect-level for COPEC X in test species T (mg/kg-day).
LD_{50TX}	=	the acute lethal dose to 50 percent of the test population of test species T for COPEC X (mg/kg).
$NOAEL_{TY}$	=	the no-observed-adverse-effect-level for compound Y (closely related to COPEC X) in test species T (mg/kg-day).
LD_{50TY}	=	the acute lethal dose to 50 percent of the test population of test species T for compound Y.

4.2.5.3 Aquatic Macroinvertebrates

Several sources were utilized to evaluate the toxicity of surface water COPECs to freshwater biota. EcoTox benchmark values published by EPA (1996c) and Tier II chronic benchmarks published by Suter and Tsao (1996) were used as the effects data for aquatic receptors in this risk assessment.

4.3 Risk Characterization

Ecological risks for the terrestrial and aquatic biota associated with the woodland and ephemeral drainage, respectively, were assessed by comparison of predicted exposure to benchmark toxicity values. The HQ of exposures divided by the benchmark values for the terrestrial receptors are presented in Table 4-5. HQ values greater than unity indicate potential risk based on the conservative assumptions used in the exposure models. As presented in the table, HQs greater than one were predicted for the harvest mouse, montane vole, and gray fox exposed to HMX, RDX, and TNT; and the American kestrel exposed to bis(2-ethylhexyl)phthalate. In no instance did an HQ value exceed a value of 62. Surface water may be potentially toxic to aquatic biota associate with the ephemeral drainage because of elevated concentrations of barium, beryllium, cadmium, and total lead (Table 4-6).

Although ecological risks were predicted, actual ecological risks are expected to be lower than those presented in Tables 4-4 and 4-5. All small mammals are expected to have home ranges within the confines of the site, so risks may actually be present for those species. For the kestrel and fox, however, risks are expected to be lower based on the large home range size of the species and the actual amount of time spent within the boundaries of TA-14. Risk to aquatic biota is expected to be very low due to the very temporary nature of the ephemeral drainage system, which may not be suitable for aquatic life regardless of potentially elevated levels of barium, beryllium, cadmium, and lead. Also, the exposure/risk predictions were based on concentrations that represent the upper bounds of expected mean concentrations. Such concentrations may not reflect actual exposure at TA-14. Overall, ecological risks at the site are expected to be low.

4.4 Uncertainties

Many uncertainties are associated with the characterization of ecological risks at TA-14. These uncertainties result in the use of assumptions in estimating risk that may lead to an overestimation or underestimation of the true risk presented at a site. For this screening level risk assessment, assumptions are made that are more likely to overestimate risk rather than to underestimate it. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of the maximum measured soil concentration or 95 percent UCL to evaluate risk, the use of wildlife toxicity benchmarks based on NOAEL values, the use earthworm-based transfer factors or a default factor of 1.0 for modeling COPECs into soil invertebrates in the absence of insect data, and the use of 1.0 as the area use factor for wildlife receptors regardless of seasonal use or home range size. Uncertainties also exist with regard to whether the ephemeral drainage can support aquatic life and the degree of runoff that reaches the drainage from TA-14.

Table 4-5
Ecological Hazard Quotients for Terrestrial Receptors at LANL Technical Area 14

Constituent of Potential Ecological Concern	Receptor Species						
	Plants	Western harvest mouse	Vagrant shrew	Montane vole	American kestrel	Gray fox	Mexican spotted owl
Bis (2-ethylhexyl) phthalate	NAa	3.58E-02	4.95E-02	1.98E-04	**1.36E+00**[b]	5.34E-03	2.08E-03
HMX	NA	**5.56E+01**	4.27E-04	**6.14E+01**	NA	**1.26E+01**	NA
RDX	1.36E-02	**5.63E+00**	9.09E-06	**4.24E+00**	NA	**1.14E+00**	NA
Tetryl	8.08E-02	1.46E-01	9.43E-05	5.16E-02	NA	2.52E-02	NA
TNT	8.73E-01	**1.56E+01**	1.08E-03	**5.81E+00**	NA	**2.71E+00**	NA
Total Beryllium	3.45E-01	2.25E-01	1.22E-02	1.20E-02	NA	4.99E-02	NA
Cadmium	3.70E-01	6.36E-02	1.39E-03	5.03E-02	9.32E-02	1.56E-02	1.18E-03
Total Lead	9.83E-01	4.85E-02	2.09E-02	5.18E-02	1.50E-01	2.50E-02	1.89E-02

[a]NA designates insufficient toxicity data available for risk estimation purposes.
[b]**Bold** values indicate a hazard quotient greater than unity.

Table 4-6
Comparison of Surface Water Concentrations to Ecological Benchmark Values for LANL Technical Area 14

Constituent of Potential Ecological Concern	Surface Water	
	Site Concentration (μg/L)	Benchmark (μg/L)
Barium	87	4.0[a]
Beryllium	1.45	0.66[a]
Cadmium	1.40	1.0[b]
Chromium	4.71	180[b]
Total Lead	5.59	2.5[b]

[a]Tier II values are presented in Suter and Tsao, 1996.
[b]EPA, 1996b Ecotox thresholds (Ambient Water Quality Criteria).

5.0 References

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LA-12913-MS

Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff Los Alamos, New Mexico

Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

LA-12913-MS

UC-903
Issued: May 1996

Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff Los Alamos, New Mexico

Patrick A. Longmire
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ence. The UTL is a "hot measurement" est—meaning that site data that are greater than the UTL-calculated threshold value are "in excess" of normal maximum background concentration for a particular element. Values of UTL for naturally occurring metals and nonmetals in soil samples, which encompassed A, B, and C horizons at the Laboratory, are presented in Table 4. These values are also extrapolated for radioisotopes of K, Th, and U by assuming natural abundance of each isotope.

Table 4. List of Upper Tolerance Limits (UTLs) for LANL Soil Background Data

Analyte	SAL (mg/kg)	Mean[a] (mg/kg)	Standard Deviation (mg/kg)	UTL 99%,0.95 (mg/kg)	N	N > DL
Aluminum (LT)	78,000	19000	13800	123000	47	47
Antimony	31	2.45	0.36	2.5 (MAX)	46	2
Arsenic		4.4	2.5	11.6	46	46
Barium (LT)	5,300	161	129	1140	47	47
Beryllium		1.15	0.75	3.31	47	47
Cadmium	38	0.39	0.54	2.7 (MAX)	47	5
Calcium (LT)		5790	12500	54400	47	47
Chromium (Total)[b]		11.7	7.8	34.2	47	47
Cobalt	4,600	15.2	7.6	51.1	47	47
Copper	2,800	5.3	3.6	15.7	47	45
Iron		14500	7320	35600	47	47
Lead	400	15.0	8.3	39.0	47	44
Magnesium (LT)		2920	2150	16100	47	47
Manganese	390	343	238	1030	47	47
Mercury	23	0.05	0.01	0.1 (MAX)	48	4
Molybdenum	380	NA	NA	NA	NA	NA
Nickel	1,500	9.7	5.9	26.7	47	45
Potassium		2420	1304	6180	47	47
Selenium	380	0.43	0.41	1.7 (MAX)	46	23
Silver	380	NA	NA	NA	NA	NA
Sodium		577	453	1880	47	47
Strontium	46,000	NA	NA	NA	NA	NA
Thallium	6.4	0.27	0.24	0.9 (MAX)	45	21
Uranium, natural	29	0.86	0.43	2.09	46	46
Vanadium	540	25	14	66	47	47
Zinc	23,000	41	21	101	47	47
40-Potassium[c]		21.6	5.07	36.1	50	50
232-Thorium[c]	0.77	1.71	0.34	2.68	50	50
234-Uranium[c]	13	1.21	0.29	2.03	50	50
235-Uranium[c]	10	0.052	0.012	0.088	50	50
238-Uranium[c]	67	1.14	0.27	1.90	50	50

[a]Concentration values <DL (detection limit) were replaced by 1/2 of the DL.

[b]SAL for Chromium-III is 80,000 mg/kg and for Chromium-VI is 30 mg/kg.

[c]Data are converted from elemental concentrations reported in this LANL background report (units are pCi/g).

LT - UTL is based on log transformed data.

NA - data not available for LANL background.

MAX - Maximum value is reported, rather than the UTL.

Los Alamos
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memorandum

Chemical Science and Technology
CST-12 · Organic Analysis
Los Alamos, New Mexico 87545

To/MS: Michael Alexander/ESH-16/MS K497
Thru: Gerald Ansell/CST-12/MS E517
From/MS: Betty Harris/CST-12/MS G740
Phone/FAX: 5-3410/5-9345
Symbol: CST-12:96-188
Date: 9/13/96

CONTAMINANTS AT TA-14, Q-SITE

During the summer of 1995 a university team from Hobbs Junior College and I constructed sample collectors at twelve locations at Q-SITE, TA-14. The purpose of the project was to quantify the concentrations of contaminants of concern (COC). Water and soil samples were collected and analyzed for volatile organics, semi-volatile organics, explosives, and metals. Also, samples were screened for radiation.

Results obtained using Gas Chromatography and Mass Spectroscopy (GC/MS), showed no detectable amounts of volatile and semi-volatile organics. However, high performance liquid chromatography (HPLC) analyses confirmed parts per billion (ppb) levels of explosives in the soil at two sample points QCS-3 and QWS-1.* Small pieces of uranium oxide were found in and around a sump, Q-43 (west and near Gun Facility), and along the lower bottom edge, QWW-1, of a recently installed access road. Otherwise, no radiation was detected in the samples.

The United States Environmental Protection Agency (US-EPA) method SW846-7000 series, which uses an atomic absorption spectrophotometer with a graphite furnace detector, was employed to determine metal contamination soil and waste samples. Parts per million (ppm) levels of barium, beryllium, cadmium, chromium, and lead were detected.

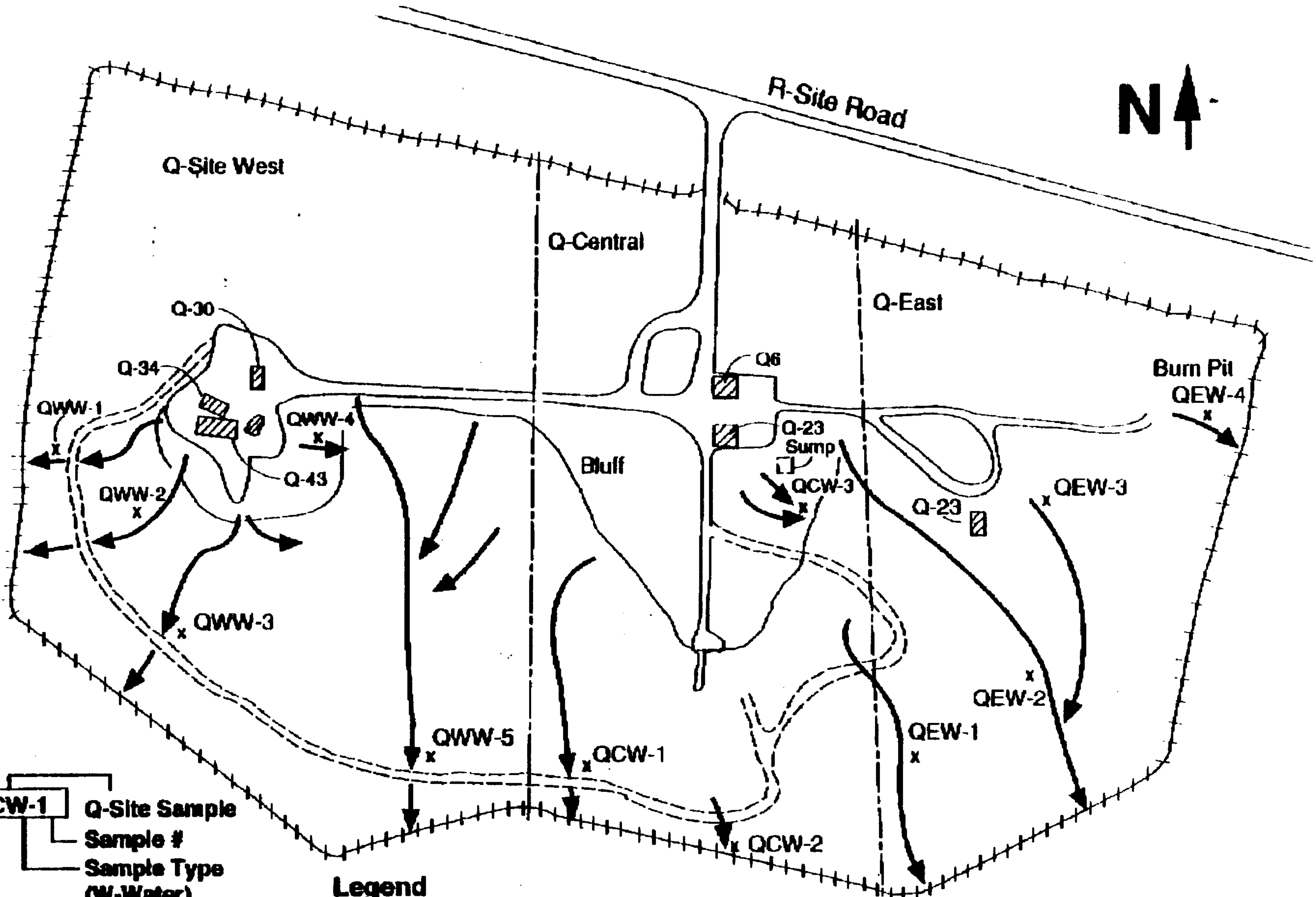
US-EPA SW846 Method 8330 was used by Wayne King, DX-2, to analyze soil and water samples possibly contaminated with explosives.

The concentrations of volatile and semi-volatile organics in soil and water samples were determined by Jeff Roberts of CST-12 by standard US-EPA methods.

The paper describing this work has not been published. Please contact me if you need more information.

---

* Consult ledger on Figure 1 for an explanation of sample nomenclature.



QCW-1
- Q-Site Sample
- Sample #
- Sample Type (W-Water) (S-Soil)
- Site Area (C-Central) (W- West) (E-East)

Legend

- Natural Runoff Paths (Arroyos)
- Fence
- Unpaved Road
- x Water Sample Location
- Δ Soil Sample Location

EES-5 Sample Locations For TA-14, "Q-Site"

UNM NMIMT DOE LANL SANDIA NMSU

HOWE Laboratory

5317 Lovington Highway 505-392-5603 ext. 634 Hobbs, NM 88240

New Mexico Junior College

Metals

Dr. Betty Harris
Los Alamos National Laboratories
~~MS C920~~
Los Alamos, NM 87545

February 27, 1996

Dr. Harris,

Here are the results of the total metals analyses for the soil samples from the project with Professor Jerry Brian at New Mexico Junior College. These soils were digested in dilute nitric acid with subsequent addition of hydrogen peroxide to extract the metals.

TOTAL METALS (ppm)

SAMPLE	Ba	Be	Cd	Cr	Pb	METHOD
QCS-1	300	4.6	0.46	11	38	SW-846 7000 Series
QCS-2	120	2.6	0.14	7.2	30	SW-846 7000 Series
QCS-3	330	2.4	3.4	9.2	62	SW-846 7000 Series
QES1	130	2.8	0.10	13	26	SW-846 7000 Series
QES-2	270	3.0	0.32	10	38	SW-846 7000 Series
QES-3	530	3.3	0.20	16	72	SW-846 7000 Series
QES-3 dup	570	3.7	0.14	18	86	SW-846 7000 Series
QES-4	480	3.6	0.16	12	28	SW-846 7000 Series
QWS-1	170	2.2	0.08	5.2	24	SW-846 7000 Series
QWS-2	140	2.2	0.20	6.0	24	SW-846 7000 Series
QWS-3	120	2.8	0.24	6.0	13	SW-846 7000 Series
QWS-4	170	1.8	0.72	9.0	40	SW-846 7000 Series
QWS-5	210	3.8	0.32	11	48	SW-846 7000 Series

NOTE: The SW-846 7000 series analyses by graphite furnace for the above metals bear the following method numbers:

Metal	Method Number
Barium	7081
Beryllium	7091
Cadmium	7131A
Chromium	7191
Lead	7421

[illegible]

Typical recoveries are as follows:

Metal	Sample	%Recovery
Barium	QEW-4	130
Beryllium	QEW-4	71
Cadmium	QEW-4	67
Lead	QWW-6	102

Dr. Harris,

Thank you for your patience. The new instrument I ran these samples on was fraught with defect. It took a long while to bring the instrument up to my standard. The good news is that I have it functioning well now, and should you need more work of this type, it will take a few days, instead of a few months. The report for the soils metals analyses should arrive in 2-3 days.

Sincerely,

Douglas Strong

Douglas Strong, Ph. D.

Appendix E

Surface Water Runoff Data for Q-Site at Technical Area 14

Los Alamos
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memorandum

Chemical Science and Technology
CST-12 - Organic Analysis
Los Alamos, New Mexico 87545

To/MS: Michael Alexander/ESH-16/MS K497
Thru: Gerald Ansell/CST-12/MS E517
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The United States Environmental Protection Agency (US-EPA) method SW846-700 series, which uses an atomic absorption spectrophotometer with a graphite furnace detector, was employed to determine metal contamination soil and waste samples. Parts per million (ppm) levels of barium, beryllium, cadmium, chromium, and lead were detected.

US-EPA SW846 Method 8330 was used by Wayne King, DX-2, to analyze soil and water samples possibly contaminated with explosives.

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The paper describing this work has not been published. Please contact me if you need more information.

---

* Consult ledger on Figure 1 for an explanation of sample nomenclature.

UNM NMIMT DOE LANL SANDIA NMSU

HOWE Laboratory

5317 Lovington Highway 505-392-5603 ext. 634 Hobbs, NM 88240

New Mexico Junior College

Dr. Betty Harris
Los Alamos National Laboratories
MS C920
Los Alamos, NM 87545

January 26, 1996

Dr. Harris,

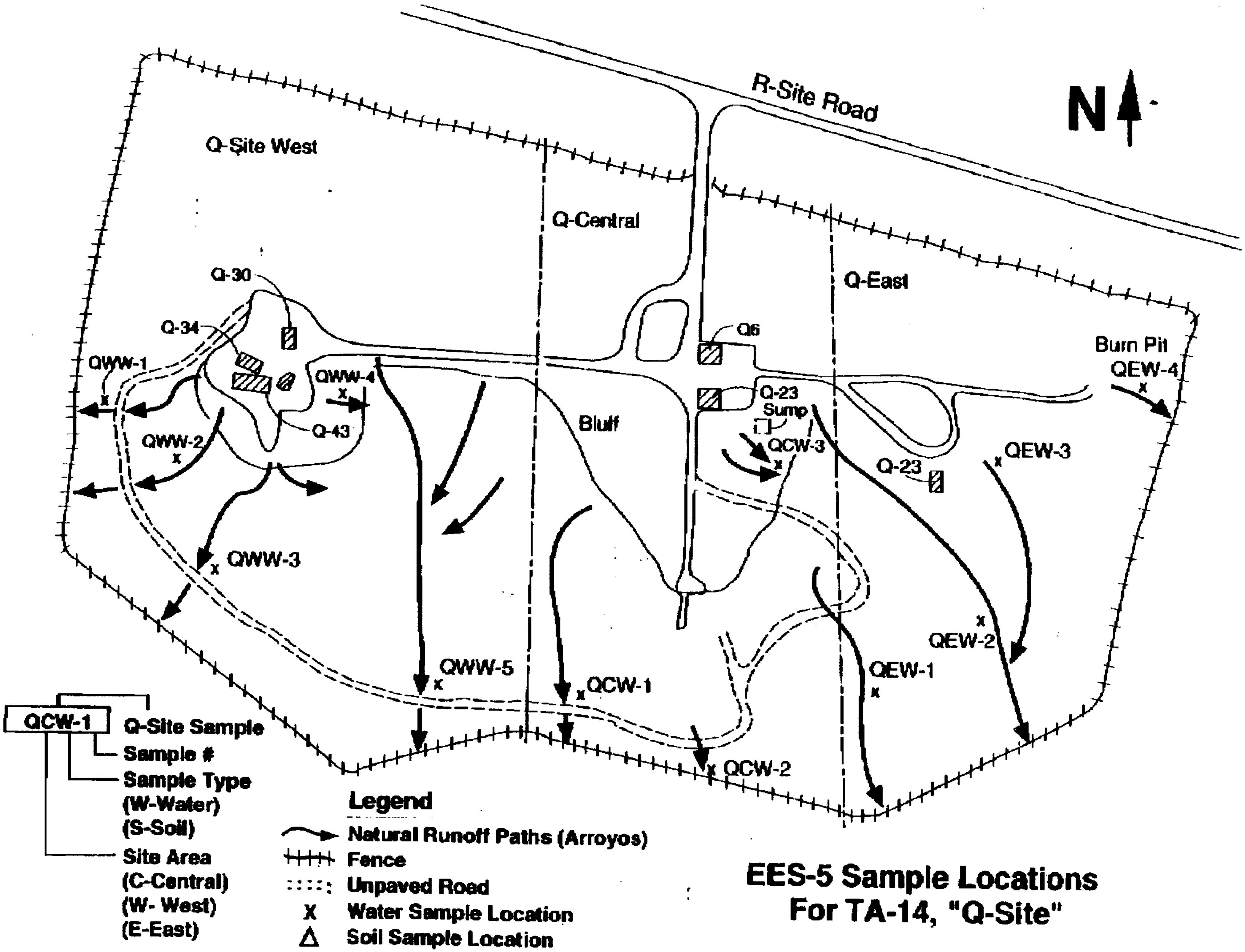
The results for the 10 water samples submitted for analysis for the metals barium, beryllium, cadmium, chromium and lead follow. Results are given in micrograms/liter.

TOTAL METALS (ug/L)

SAMPLE	Ba	Be	Cd	Cr	Pb	METHOD
QEW-1	120	3	1.0	5.8	11	SW-846 7000 Series
QEW-3	115	<0.1	1.0	5.1	<1.0	SW-846 7000 Series
QEW-4	66	0.5	2.8	4.8	1.0	SW-846 7000 Series
QWW-1	40	0.5	<0.1	2.6	<1.0	SW-846 7000 Series
QWW-2,3	45	<0.1	<0.1	2.8	1.0	SW-846 7000 Series
QWW-4	70	<0.1	<0.1	2.7	1.8	SW-846 7000 Series
QWW-6	70	1.7	1.9	1.9	2.7	SW-846 7000 Series
QCW-1	25	0.8	<0.1	4.2	2.8	SW-846 7000 Series
QCW-2	26	0.9	<0.1	3.9	5.1	SW-846 7000 Series
QCW-3	57	0.3	<0.1	4.3	5.9	SW-846 7000 Series

NOTE: The SW-846 7000 series analyses by graphite furnace for the above metals bear the following method numbers:

Metal	Method Number
Barium	7081
Beryllium	7091
Cadmium	7131A
Chromium	7191
Lead	7421



EES-5 Sample Locations For TA-14, "Q-Site"

Appendix F

Analytical Data for Soil Samples Collected Near Technical Area 14, Building 23

ok
N1 5/02 [illegible]
766969.10
Rec'd from
Tony Griggs (ESH[illegible])
th 6/27/97

EM-9 SEMIVOLATILE ORGANIC ANALYSIS
SUMMARY OF ANALYTICAL RESULTS

TO: Philip R. Fresquez
FROM: Bridgid Brug, EM-9 Organic section
THROUGH: Chris Leibman, EM-9 Organic section leader
Anthony Lombardo, EM-9 Organic section TL 5/26
REQUEST NUMBER: 14401
MATRIX: Soil
SUMMARY DATE: May 4, 1993

ppb

	SAMPLE ID	TARGET COMPOUNDS FOUND	AMOUNT (ug/Kg)	LOQ (ug/Kg)	TICs	
	93.04902 (Blank)	NONE	<330	330	N	
	93.04903 (Blank)	NONE	<330	330	N	
	93.04845	NONE	<330	330	Y	
	93.04846	NONE	<330	330	Y	
	93.04847	NONE	<330	330	N	
E-35	93.04848	BIS-2-ETHYLHEXYLPHTHALATE	690	330	Y	< 50 ppm ok
		DI-N-OCTYPHTHALATE	690			< [illegible] 60,000 ppm ok
E-50	93.04849*	BIS-2-ETHYLHEXYLPHTHALATE	1100	330	N	ok
	93.04850	NONE	<330	330	Y	
	93.04851	NONE	<330	330	Y	
	93.04852	NONE	<330	330	Y	
	93.04853*	NONE	<330	330	Y	
	93.04854	NONE	<330	330	Y	ok
SE-50	93.04855*	BIS-2-ETHYLHEXYLPHTHALATE	870	330	Y	
	93.04856	NONE	<330	330	Y	
	93.04857*	NONE	<330	330	Y	
	93.04858	NONE	<330	330	Y	
	93.04859	NONE	<3300	3300	N	
	93.04860*	NONE	<330	330	N	
	93.04861	NONE	<330	330	N	
	93.04862*	NONE	<330	330	Y	
	93.04863	NONE	<330	330	Y	
	93.04864	NONE	<330	330	Y	
S-50	93.04865*	PYRENE	3800	3300	N	<80ppm
	93.04866	NONE	<330	330	Y	
	93.04867*	NONE	<3300	3300	N	
U.D.	93.04868	BIS-2-ETHYLHEXYLPHTHALATE	540	330	Y	ok
L.O.	93.04869*	NONE	<330	330	Y	

LOQ: Limit Of Quantitation
TICs: Tentatively identified compounds
*: Low internal standard responses (confirmed by reanalysis)

Samples were extracted by mixing approximately 30 grams of sample with 60 grams of sodium sulfate and sonicating with 100 ml of methylene chloride. The methylene chloride was separated from the solids and sonication was repeated with two additional 100 ml aliquot of methylene chloride. Most of he sample extracts were combined and concentrated to 1.0 ml final volume.

The following samples were combined and concentrated to 10.0 ml final volume: 93.04859, S93.04865, M93.04865, D93.04865, and S93.04867. Appropriate surrogate standards were added prior to extraction. Analysis was performed by capillary column GC/MS methods. Extraction and analysis methods are consistent with EPA SW-846 methods 3500 and 8270. Analytical column used was a J&W scientific DB5.625 30 M X .25 mm ID.

Some of the samples were found to contain HSL target compounds above the specified limit of quantitation (see above). Non-target peaks were not identified or quantitated for this request.

Surrogate recoveries were within EPA criteria for all analyses. Many of the samples had low internal standard responses. All of these samples were analyzed twice in order to confirm matrix interference.

All analytical hold times were met for this request. If you have any question regarding this data, please call either Anthony Lombardo or Laura Kelly at 667-5889.

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
SURROGATE RECOVERIES FOR SEMI-VOLATILES
IN SOIL TYPE MATRICES

REQUEST #: 14401

NUMBER OF SAMPLES: 22
MATRIX S
ANALYST: AJL
Date: 05/14/93

SURROGATE RECOVERIES

SURROGATE
RECOVERIES IN PERCENT (%)

	SAMPLE NUMBERS	TYPE	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
1	B93.04903	BLANK	19 *	24	26	35	64	89
2	B93.04902	BLANK	18 *	29	36	48	71	95
3	S93.04899	SAMPLE	63	73	75	74	89	88
4	S93.04900	SAMPLE	56	67	64	69	85	78
5	M93.04845	MATRIX SPIK	54	74	67	76	94	86
	D93.04845	MATRIX SP-D	41	63	55	67	86	85
	S93.04845	SAMPLE	30	48	46	66	82	78
	S93.04846	SAMPLE	38	58	52	68	88	86
.	S93.04847	SAMPLE	39	61	52	75	91	96
10	S93.04848	SAMPLE	31	54	46	63	89	102
11	S93.04849	SAMPLE	43	69	61	95	108	123
12	S93.04850	SAMPLE	28	48	43	60	92	100
13	S93.04851	SAMPLE	38	57	54	69	76	89
14	S93.04852	SAMPLE	42	66	58	73	93	98
15	S93.04853	SAMPLE	40	55	54	66	78	90
16	S93.04854	SAMPLE	41	63	53	71	90	94
17	S93.04855	SAMPLE	36	65	52	80	110	108
18	S93.04856	SAMPLE	41	61	53	66	95	87
19	S93.04857	SAMPLE	54	75	71	91	115	115
20	S93.04858	SAMPLE	52	78	64	81	101	85
21	S93.04859	SAMPLE	60	82	74	83	102	93
22	S93.04860	SAMPLE	58	78	68	82	106	109

	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
Average % Surrogate Recovery...	39	55	52	64	84	88
Defined Lower QC Limits (%)....	23	24	23	30	19	18
Defined Upper QC Limits (%)....	121	113	120	115	122	137
Observed Lower QC Limits (%)...	18	24	26	35	64	78
Observed Upper QC Limits (%)...	63	74	75	76	94	102

If % Surrogate Recovery is Followed by a "*", it is out of QC Limits.

Re By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
SURROGATE RECOVERIES FOR SEMI-VOLATILES
IN SOIL TYPE MATRICES

REQUEST #: 14401

NUMBER OF SAMPLES: 11
MATRIX S
ANALYST: AJL
Date: 05/14/93

SURROGATE RECOVERIES

SURROGATE
RECOVERIES IN PERCENT (%)

	SAMPLE NUMBERS	TYPE	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
1	M93.04865	MATRIX SPIK	73	90	79	88	83	113
2	D93.04865	MATRIX SP-D	73	93	78	92	90	116
3	S93.04861	SAMPLE	36	51	44	57	93	88
4	S93.04862	SAMPLE	56	80	68	80	90	104
5	S93.04863	SAMPLE	46	65	61	86	124 *	122
6	S93.04864	SAMPLE	67	84	82	89	101	127
	S93.04865	SAMPLE	72	86	84	84	81	114
	S93.04866	SAMPLE	43	59	54	65	94	95
	S93.04867	SAMPLE	79	88	75	90	97	118
10	S93.04868	SAMPLE	67	86	74	85	109	95
11	S93.04869	SAMPLE	83	99	90	91	115	117
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
Average % Surrogate Recovery...	61	78	70	82	96	109
Defined Lower QC Limits (%)....	23	24	23	30	19	18
Defined Upper QC Limits (%)....	121	113	120	115	122	137
Observed Lower QC Limits (%)...	36	51	44	57	81	88
Observed Upper QC Limits (%)...	79	93	84	92	124	127

"*" If % Surrogate Recovery is Followed by a "*", it is out of QC Limits.

Re By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
MATRIX SPIKE RECOVERIES FOR SEMI-VOLATILES

		DRY WT/VOL (G or L)		AMOUNT SPIKED IN UG/KG		
REQUEST #:	14401					
NUMBER OF SAMPLES:	22			ACIDS	BASES	LOQ (UG/KG)
SPIKE ID: (STARTS M OR E)	M93.04845	SPIKE	28.662	3489	1744	330
SPIKE DUP ID: (STARTS D OR F)	D93.04845	SPIKE-DUP	28.277	3536	1768	330
RAW DATA WITH:	14401					
ANALYST:	AJL					

	SPIKE REC.	SPIKE-DUP REC.	SPIKE % REC.	SPIKE-DUP % REC.	RPD	LOW. REC. LIM.	UPP. REC. LIM.	RPD LIM.
[illegible]	2300	1900	66%	54%	20%	26	90	35
2-[illegible]OROPHENOL	2400	1900	69%	54%	25%	25	102	50
1,4-DICHLOROBENZENE	1100	870	63%	49%	25%	28	104	27
N-NITROSO-DI-N-PROPYLAMINE	1300	1100	75%	62%	18%	41	126	38
1,2,4-TRICLOROBENZENE	1200	950	69%	54%	25%*	38	107	23
4-CHLORO-3-METHYLPHENOL	2300	2200	66%	62%	6%	26	103	33
ACENAPHTHENE	1300	1200	75%	68%	9%	31	137	19
4-NITROPHENOL	2500	2600	72%	74%	3%	11	114	50
2,4-DINITROTOLUENE	1400	1300	80%	74%	9%	28	89	47
PENTACHLOROPHENOL	3000	2800	86%	79%	8%	17	109	47
PYRENE	1500	1500	86%	85%	1%	35	142	36

"*" If % Matrix Recovery is Followed by a "*", it is out of QC Limits.

Reviewed By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
MATRIX SPIKE RECOVERIES FOR SEMI-VOLATILES

		DRY WT/VOL (G or L)	AMOUNT SPIKED IN UG/KG ACIDS	BASES	LOQ (UG/KG)
REQUEST #:	14401				
NUMBER OF SAMPLES:	11				
SPIKE ID: (STARTS M OR E)	M93.04865	SPIKE 27.931	3580	1790	3300
SPIKE DUP ID: (STARTS D OR F)	D93.04865	SPIKE-DUP27.493	3637	1819	3300
RAW DATA WITH:	14401				
ANALYST:	AJL				

	SPIKE REC.	SPIKE-DUP REC.	SPIKE % REC.	SPIKE-DUP % REC.	RPD	LOW. REC. LIM.	UPP. REC. LIM.	RPD LIM.
	<LOQ	<LOQ	0%*	0%*	ERR **	26	90	35
2-…OROPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	25	102	50
1,4-DICHLOROBENZENE	<LOQ	<LOQ	0%*	0%*	ERR **	28	104	27
N-NITROSO-DI-N-PROPYLAMINE	<LOQ	<LOQ	0%*	0%*	ERR **	41	126	38
1,2,4-TRICLOROBENZENE	<LOQ	<LOQ	0%*	0%*	ERR **	38	107	23
4-CHLORO-3-METHYLPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	26	103	33
ACENAPHTHENE	<LOQ	<LOQ	0%*	0%*	ERR **	31	137	19
4-NITROPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	11	114	50
2,4-DINITROTOLUENE	<LOQ	<LOQ	0%*	0%*	ERR **	28	89	47
PENTACHLOROPHENOL	<LOQ	<LOQ	0%*	0%*	ERR **	17	109	47
PYRENE	<LOQ	<LOQ	0%*	0%*	ERR **	35	142	36

If % Matrix Recovery is Followed by a "*", it is out of QC Limits.

Reviewed By:

EM-9 SEMIVOLATILE ORGANIC ANALYSIS
SUMMARY OF ANALYTICAL RESULTS

TO: Philip R. Fresquez
FROM: Bridgid Brug, EM-9 Organic section
THROUGH: Chris Leibman, EM-9 Organic section leader
Anthony Lombardo, EM-9 Organic section TL 5/19/93
REQUEST NUMBER: 14401
MATRIX: Water
SUMMARY DATE: May 4, 1993

SAMPLE ID	TARGET COMPOUNDS FOUND	AMOUNT (ug/L)	LOQ (ug/L)	TICs (Y/N)
93.05027 (Blank)	NONE	<10	10	Y
93.04870	BENZOIC ACID	58	10	Y

LOQ: Limit Of Quantitation
TIC: Tentatively Identified Compound

Samples were extracted by liquid-liquid extraction method. Methylene chloride was used as the extraction solvent. Sample extracts were then concentrated to 1.0 ml final volume. Appropriate surrogate standards were added prior to extraction. Analysis was performed by capillary column GC/MS methods. Extraction and analysis methods are consistent with EPA SW-846 methods 3520 and 8270. Analytical column used was a J&W Scientific DB.625 30M by 0.25 mm ID, 0.5 micron film.

The sample extract was found to contain HSL target compounds above the specified limit of quantitation (see above). Non-target compounds were not identified or quantitated for this request.

Surrogate recoveries were within EPA criteria for all analyses. Internal standard responses were within criteria for all analyses.

All analytical hold times were met for this request. If you have any questions regarding this data, please call either Anthony Lombardo or Laura Kelly at 667-5889.

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
SURROGATE RECOVERIES FOR SEMI-VOLATILES
IN WATER

REQUEST #: 14401

NUMBER OF SAMPLES: 5
MATRIX W
ANALYST: AJL
Date: 05/26/93

SURROGATE RECOVERIES

SURROGATE
RECOVERIES IN PERCENT (%)

	SAMPLE NUMBERS	TYPE	2-FLUORO-PHENOL	PHENOL (D6)	NITRO-BENZENE (D5)	2-FLUORO-BIPHENYL	2,4,6-TRIBROMO-PHENOL	TERPHENYL (D14)
1	B93.05027	BLANK	57	72	63	57	52	86
2	S93.04762	SAMPLE	40	52	47	53	58	81
3	E93.04764	BLANK SPIKE	30	35	56	56	40	77
4	F93.04764	BLANK SP-DU	26	35	36	42 *	42	86
5	S93.04870	SAMPLE	54	67	72	72	96	30 *
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
	Average % Surrogate Recovery...		41	52	55	56	58	72
	Defined Lower QC Limits (%)....		21	10	35	43	10	33
	Defined Upper QC Limits (%)....		100	94	114	116	123	141
	Observed Lower QC Limits (%)...		26	35	36	42	40	30
	Observed Upper QC Limits (%)...		57	72	72	72	96	86

" 'f % Surrogate Recovery is Followed by a "*", it is out of QC Limits.

Re\ By:

LOS ALAMOS NATIONAL LABORATORY
HEALTH, SAFETY AND ENVIRONMENT DIVISION
HSE-9
MATRIX SPIKE RECOVERIES FOR SEMI-VOLATILES

		DRY WT/VOL (G or L)		AMOUNT SPIKED (50 OR 100 ug/ml) IN UG/KG or UG/L ACIDS	BASES	LOQ (UG/KG)
REQUEST #:	14401					
NUMBER OF SAMPLES:	5					
SPIKE ID: (STARTS M OR E)	E93.04764	SPIKE	1	100	50	10
SPIKE DUP ID: (STARTS D OR F)	F93.04764	SPIKE-DUP	1	100	50	10
RAW DATA WITH:	14388					
ANALYST:	AJL					

	SPIKE REC.	SPIKE-DUP REC.	SPIKE % REC.	SPIKE-DUP % REC.	RPD	LOW. REC. LIM.	UPP. REC. LIM.	RPD LIM.
	35	36	35%	36%	3%	12	89	42
2-[illegible]ROPHENOL	36	32	36%	32%	12%	27	123	40
1,4-DICHLOROBENZENE	22	14	44%	28%*	44%*	36	97	28
N-NITROSO-DI-N-PROPYLAMINE	31	20	62%	40%*	43%*	41	116	38
1,2,4-TRICLOROBENZENE	23	15	46%	30%*	42%*	39	98	28
4-CHLORO-3-METHYLPHENOL	44	41	44%	41%	7%	23	97	42
ACENAPHTHENE	31	24	62%	48%	25%	46	118	31
4-NITROPHENOL	31	<LOQ	31%	0%*	200%*	10	80	50
2,4-DINITROTOLUENE	39	15	78%	30%	89%*	24	96	38
PENTACHLOROPHENOL	47	<LOQ	47%	0%*	200%*	9	103	50
PYRENE	43	46	86%	92%	7%	26	127	31

If % Matrix Recovery is Followed by a "*", it is out of QC Limits.

Reviewed By:

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 26-May-1993

REQUEST NUMBER: 14401 MATRIX: W ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 39

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04870 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-RIN	93.04870	83329	< 10.		UG/L	5/25/93		Acenaphthene
14-35-RIN	93.04870	208968	< 10.		UG/L	5/25/93		Acenaphthylene
14-35-RIN	93.04870	62533	< 10.		UG/L	5/25/93		Aniline
14-35-RIN	93.04870	120127	< 10.		UG/L	5/25/93		Anthracene
14-35-RIN	93.04870	103333	< 10.		UG/L	5/25/93		Azobenzene
14-35-RIN	93.04870	92875	< 10.		UG/L	5/25/93		m-Benzidine
14-35-RIN	93.04870	56553	< 10.		UG/L	5/25/93		Benzo[a]anthracene
14-35-RIN	93.04870	50328	< 10.		UG/L	5/25/93		Benzo[a]pyrene
14-35-RIN	93.04870	205992	< 10.		UG/L	5/25/93		Benzo[b]fluoranthene
14-35-RIN	93.04870	191242	< 10.		UG/L	5/25/93		Benzo[g,h,i]perylene
14-35-RIN	93.04870	207089	< 10.		UG/L	5/25/93		Benzo[k]fluoranthene
14-35-RIN	93.04870	65850	58.	17.4	UG/L	5/25/93		Benzoic acid
14-35-RIN	93.04870	100516	< 10.		UG/L	5/25/93		Benzyl alcohol
14-35-RIN	93.04870	111911	< 10.		UG/L	5/25/93		Bis(2-chloroethoxy)methane
14-35-RIN	93.04870	111444	< 10.		UG/L	5/25/93		Bis(2-chloroethyl)ether
14-35-RIN	93.04870	108601	< 10.		UG/L	5/25/93		Bis(2-chloroisopropyl)ether
14-35-RIN	93.04870	117817	< 10.		UG/L	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-RIN	93.04870	101553	< 10.		UG/L	5/25/93		4-Bromophenylphenyl ether
14-35-RIN	93.04870	85687	< 10.		UG/L	5/25/93		Butyl benzyl phthalate
14-35-RIN	93.04870	59507	< 10.		UG/L	5/25/93		4-Chloro-3-methylphenol
14-35-RIN	93.04870	106478	< 10.		UG/L	5/25/93		4-Chloroaniline
14-35-RIN	93.04870	91587	< 10.		UG/L	5/25/93		2-Chloronaphthalene
14-35-RIN	93.04870	95578	< 10.		UG/L	5/25/93		o-Chlorophenol
14-35-RIN	93.04870	7005723	< 10.		UG/L	5/25/93		4-Chlorophenylphenyl ether
14-35-RIN	93.04870	218019	< 10.		UG/L	5/25/93		Chrysene
14-35-RI'	.04870	84742	< 10.		UG/L	5/2		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-RIN	93.04870	117840	< 10.		UG/L	5/25/93		Di-n-octyl phthalate
14-35-RIN	93.04870	53703	< 10.		UG/L	5/25/93		Dibenzo[a,h]anthracene
14-35-RIN	93.04870	132649	< 10.		UG/L	5/25/93		Dibenzofuran
14-35-RIN	93.04870	95501	< 10.		UG/L	5/25/93		o-Dichlorobenzene (1,2)
14-35-RIN	93.04870	541731	< 10.		UG/L	5/25/93		m-Dichlorobenzene (1,3)
14-35-RIN	93.04870	106467	< 10.		UG/L	5/25/93		p-Dichlorobenzene (1,4)
14-35-RIN	93.04870	91941	< 10.		UG/L	5/25/93		3,3'-Dichlorobenzidine
14-35-RIN	93.04870	120832	< 10.		UG/L	5/25/93		2,4-Dichlorophenol
14-35-RIN	93.04870	84662	< 10.		UG/L	5/25/93		Diethyl phthalate
14-35-RIN	93.04870	131113	< 10.		UG/L	5/25/93		Dimethyl phthalate
14-35-RIN	93.04870	105679	< 10.		UG/L	5/25/93		2,4-Dimethylphenol
14-35-RIN	93.04870	51285	< 10.		UG/L	5/25/93		2,4-Dinitrophenol
14-35-RIN	93.04870	121142	< 10.		UG/L	5/25/93		2,4-Dinitrotoluene
14-35-RIN	93.04870	606202	< 10.		UG/L	5/25/93		2,6-Dinitrotoluene
14-35-RIN	93.04870	206440	< 10.		UG/L	5/25/93		Fluoranthene
14-35-RIN	93.04870	86737	< 10.		UG/L	5/25/93		Fluorene
14-35-RIN	93.04870	118741	< 10.		UG/L	5/25/93		Hexachlorobenzene
14-35-RIN	93.04870	87683	< 10.		UG/L	5/25/93		Hexachlorobutadiene
14-35-RIN	93.04870	77474	< 10.		UG/L	5/25/93		Hexachlorocyclopentadiene
14-35-RIN	93.04870	67721	< 10.		UG/L	5/25/93		Hexachloroethane
14-35-RIN	93.04870	193395	< 10.		UG/L	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-RIN	93.04870	78591	< 10.		UG/L	5/25/93		Isophorone
14-35-RIN	93.04870	534521	< 10.		UG/L	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-RIN	93.04870	91576	< 10.		UG/L	5/25/93		2-Methylnaphthalene
14-35-RIN	93.04870	95487	< 10.		UG/L	5/25/93		2-Methylphenol
14-35-RIN	93.04870	106445	< 10.		UG/L	5/25/93		4-Methylphenol
14-35-RIN	93.04870	91203	< 10.		UG/L	5/25/93		Naphthalene
14-35-RIN	93.04870	88744	< 10.		UG/L	5/25/93		2-Nitroaniline
14-35-RIN	93.04870	99092	< 10.		UG/L	5/25/93		3-Nitroaniline
14-35-RIN	93.04870	100016	< 10.		UG/L	5/25/93		4-Nitroaniline
14-35-RIN	93.04870	98953	< 10.		UG/L	5/25/93		Nitrobenzene
14-35-RIN	93.04870	88755	< 10.		UG/L	5/25/93		2-Nitrophenol
14-35-RIN	93.04870	100027	< 10.		UG/L	5/25/93		4-Nitrophenol
14-35-RIN	93.04870	621647	< 10.		UG/L	5/25/93		N-Nitrosodi-n-propylamine
14-35-RIN	93.04870	62759	< 10.		UG/L	5/25/93		N-Nitrosodimethylamine
14-35-RI[illegible]	[illegible].04870	86306	< 10.		UG/L	5/2[illegible]		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-RIN	93.04870	87865	< 10.		UG/L	5/25/93		Pentachlorophenol
14-35-RIN	93.04870	85018	< 10.		UG/L	5/25/93		Phenanthrene
14-35-RIN	93.04870	108952	< 10.		UG/L	5/25/93		Phenol
14-35-RIN	93.04870	129000	< 10.		UG/L	5/25/93		Pyrene
14-35-RIN	93.04870	120821	< 10.		UG/L	5/25/93		1,2,4-Trichlorobenzene
14-35-RIN	93.04870	95954	< 10.		UG/L	5/25/93		2,4,5-Trichlorophenol
14-35-RIN	93.04870	88062	< 10.		UG/L	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04870

none

**************** EM-9 QUALITY ASSURANCE REPORT ***************

EPA SEMIVOLATILES Prepared by: BWB on 26-May-1993

REQUEST NUMBER: 14401 MATRIX: W ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 39

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QA SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

**************** EM-9 QUALITY ASSURANCE REPORT ***************

SUMMARY OF CONTROL STATUS OF BLANK QC SAMPLES RUN WITH THIS BATCH

Blank Results, Sample # 93.05027 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.05027	83329	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Acenaphthene
00.20226	93.05027	208968	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
00.20226	93.05027	62533	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Aniline
00.20226	93.05027	120127	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Anthracene
00.20226	93.05027	103333	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Azobenzene
00.20226	93.05027	92875	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	m-Benzidine
00.20226	93.05027	56553	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
00.20226	93.05027	50328	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
00.20226	93.05027	205992	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
00.20226	93.05027	191242	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
00.20226	93.05027	207089	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
00.20226	93.05027	65850	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzoic acid
00.20226	93.05027	100516	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
00.20226	93.05027	111911	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
00.20226	93.05027	111444	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
00.20226	93.05027	108601	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
00.20226	93.05027	117817	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
00.20226	93.05027	101553	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
00.20226	93.05027	85687	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
00.20226	93.05027	59507	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
00.20226	93.05027	106478	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline

**************** EM-9 QUALITY ASSURANCE REPORT ***************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.05027	91587	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
00.20226	93.05027	95578	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
00.20226	93.05027	7005723	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
00.20226	93.05027	218019	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Chrysene
00.20226	93.05027	84742	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
00.20226	93.05027	117840	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
00.20226	93.05027	53703	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
00.20226	93.05027	132649	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
00.20226	93.05027	95501	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
00.20226	93.05027	541731	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
00.20226	93.05027	106467	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
00.20226	93.05027	91941	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
00.20226	93.05027	120832	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
00.20226	93.05027	84662	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
00.20226	93.05027	131113	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
00.20226	93.05027	105679	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
00.20226	93.05027	51285	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
00.20226	93.05027	121142	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
00.20226	93.05027	606202	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
00.20226	93.05027	206440	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Fluoranthene
00.20226	93.05027	86737	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Fluorene
00.20226	93.05027	118741	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
00.20226	93.05027	87683	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
00.20226	93.05027	77474	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
00.20226	93.05027	67721	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
00.20226	93.05027	193395	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
00.20226	93.05027	78591	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Isophorone
00.20226	93.05027	534521	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
00.20226	93.05027	91576	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
00.20226	93.05027	95487	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
00.20226	93.05027	106445	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
00.20226	93.05027	91203	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Naphthalene
00.20226	93.05027	88744	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
00.20226	93.05027	99092	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
00.20226	93.05027	100016	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
00.20226	93.05027	98953	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Nitrobenzene

**************** EM-9 QUALITY ASSURANCE REPORT ***************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.05027	88755	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
00.20226	93.05027	100027	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
00.20226	93.05027	621647	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
00.20226	93.05027	62759	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
00.20226	93.05027	86306	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
00.20226	93.05027	87865	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
00.20226	93.05027	85018	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Phenanthrene
00.20226	93.05027	108952	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Phenol
00.20226	93.05027	129000	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	Pyrene
00.20226	93.05027	120821	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
00.20226	93.05027	95954	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
00.20226	93.05027	88062	< 10.		UG/L	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

REPORT NUMBER: 18672

**************** EM-9 QUALITY ASSURANCE REPORT ***************

Blank Spike Results, Sample # 93.04764 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.04764	83329	50.	31.	UG/L	0.0		5/25/93		Acenaphthene
00.20226	93.04764	59507	100.	44.	UG/L	0.0		5/25/93		4-Chloro-3-methylphenol
00.20226	93.04764	95578	100.	36.	UG/L	0.0		5/25/93		o-Chlorophenol
00.20226	93.04764	106467	50.	22.	UG/L	0.0		5/25/93		p-Dichlorobenzene (1,4)
00.20226	93.04764	121142	50.	40.	UG/L	0.0		5/25/93		2,4-Dinitrotoluene
00.20226	93.04764	100027	100.	31.	UG/L	0.0		5/25/93		4-Nitrophenol
00.20226	93.04764	621647	50.	31.	UG/L	0.0		5/25/93		N-Nitrosodi-n-propylamine
00.20226	93.04764	87865	100.	47.	UG/L	0.0		5/25/93		Pentachlorophenol
00.20226	93.04764	108952	100.	35.	UG/L	0.0		5/25/93		Phenol
00.20226	93.04764	129000	50.	43.	UG/L	0.0		5/25/93		Pyrene
00.20226	93.04764	120821	50.	23.	UG/L	0.0		5/25/93		1,2,4-Trichlorobenzene

**************** EM-9 QUALITY ASSURANCE REPORT ***************

Blank Spike Duplicate Results, Sample # 93.04764 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20226	93.04764	83329	50.	24.	UG/L	0.0		5/25/93		Acenaphthene
00.20226	93.04764	59507	100.	41.	UG/L	0.0		5/25/93		4-Chloro-3-methylphenol
00.20226	93.04764	95578	100.	32.	UG/L	0.0		5/25/93		o-Chlorophenol
00.20226	93.04764	106467	50.	14.	UG/L	0.0		5/25/93		p-Dichlorobenzene (1,4)
00.20226	93.04764	121142	50.	15.	UG/L	0.0		5/25/93		2,4-Dinitrotoluene
00.20226	93.04764	100027	100.	10.	UG/L	0.0		5/25/93		4-Nitrophenol
00.20226	93.04764	621647	50.	20.	UG/L	0.0		5/25/93		N-Nitrosodi-n-propylamine
00.20226	93.04764	87865	100.	10.	UG/L	0.0		5/25/93		Pentachlorophenol
00.20226	93.04764	108952	100.	36.	UG/L	0.0		5/25/93		Phenol
00.20226	93.04764	129000	50.	46.	UG/L	0.0		5/25/93		Pyrene
00.20226	93.04764	120821	50.	15.	UG/L	0.0		5/25/93		1,2,4-Trichlorobenzene

**************** EM-9 QUALITY ASSURANCE REPORT ***************

SUMMARY OF CONTROL STATUS OF BLIND QA SAMPLES RUN WITH THIS BATCH

Blind QC Results, Sample # 93.04762   Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/05/93 Date Analyzed: 4/28/93

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND-NAME
93.04762	83329	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Acenaphthene
93.04762	208968	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Acenaphthylene
93.04762	62533	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Aniline
93.04762	120127	59.	17.7	UG/L	78.	4.	5/10/93	UNDER CONTROL	Anthracene
93.04762	103333	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Azobenzene
93.04762	92875	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	m-Benzidine
93.04762	56553	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[a]anthracene
93.04762	50328	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[a]pyrene
93.04762	205992	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[b]fluoranthene
93.04762	191242	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[g,h,i]perylene
93.04762	207089	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzo[k]fluoranthene
93.04762	65850	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzoic acid
93.04762	100516	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Benzyl alcohol
93.04762	111911	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
93.04762	111444	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-chloroethyl)ether
93.04762	108601	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
93.04762	117817	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
93.04762	101553	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Bromophenylphenyl ether
93.04762	85687	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Butyl benzyl phthalate
93.04762	59507	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Chloro-3-methylphenol
93.04762	106478	65.	19.5	UG/L	84.	4.	5/10/93	UNDER CONTROL	4-Chloroaniline
93.04762	91587	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Chloronaphthalene
93.04762	95578	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	o-Chlorophenol
93.04762	7005723	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Chlorophenylphenyl ether
93.04762	218019	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Chrysene
93.04762	742	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Di-n-butyl phthalate

93.04762	117840	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Di-n-octyl phthalate
93.04762	53703	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Dibenzo[a,h]anthracene
93.04762	132649	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Dibenzofuran
93.04762	95501	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
93.04762	541731	27.	8.1	UG/L	80.	4.	5/10/93	OUT OF CONTROL	m-Dichlorobenzene (1,3)
93.04762	106467	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
93.04762	91941	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	3,3'-Dichlorobenzidine
93.04762	120832	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4-Dichlorophenol
93.04762	84662	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Diethyl phthalate
93.04762	131113	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Dimethyl phthalate
93.04762	105679	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4-Dimethylphenol
93.04762	51285	81.	24.3	UG/L	102.	5.	5/10/93	UNDER CONTROL	2,4-Dinitrophenol
93.04762	121142	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4-Dinitrotoluene
93.04762	606202	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,6-Dinitrotoluene
93.04762	206440	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Fluoranthene
93.04762	86737	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Fluorene
93.04762	118741	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Hexachlorobenzene
93.04762	87683	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Hexachlorobutadiene
93.04762	77474	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Hexachlorocyclopentadiene
93.04762	67721	34.	10.2	UG/L	103.	5.	5/10/93	OUT OF CONTROL	Hexachloroethane
93.04762	193395	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
93.04762	78591	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Isophorone
93.04762	534521	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
93.04762	91576	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Methylnaphthalene
93.04762	95487	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Methylphenol
93.04762	106445	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Methylphenol
93.04762	91203	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Naphthalene
93.04762	88744	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Nitroaniline
93.04762	99092	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	3-Nitroaniline
93.04762	100016	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Nitroaniline
93.04762	98953	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Nitrobenzene
93.04762	88755	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2-Nitrophenol
93.04762	100027	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	4-Nitrophenol
93.04762	621647	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
93.04762	62759	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	N-Nitrosodimethylamine
93.04762	86306	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	N-Nitrosodiphenylamine
93.04762	87865	66.	19.8	UG/L	97.	5.	5/10/93	UNDER CONTROL	Pentachlorophenol
93.04762	85018	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Phenanthrene
93.04762	108952	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Phenol
93.04762	129000	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	Pyrene
93.04762	120821	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	1,2,4-Trichlorobenzene
93.04762	95954	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4,5-Trichlorophenol
93.04762	88062	< 10.		UG/L	0.0		5/10/93	UNDER CONTROL	2,4,6-Trichlorophenol

**************** EM-9 QUALITY ASSURANCE REPORT ***************

SURROGATE RESULTS FOR EPA SEMIVOLATILES

Surrogate 1 = 2-Fluorophenol (CAS # = 367124)
Surrogate 2 = Phenol-d5 (CAS # = 4165622)
Surrogate 3 = Nitrobenzene-d5 (CAS # = 4165600)
Surrogate 4 = 2-Fluorobiphenyl (CAS # = 321608)
Surrogate 5 = 2,4,6-Tribromophenol (CAS # = 118796)
Surrogate 6 = p-Terphenyl-d14 (CAS # =)

SAMPLE NUMBER	UNITS	Surrogate 1	Surrogate 2	Surrogate 3	Surrogate 4	Surrogate 5	Surrogate 6	COMPLETION DATE
93.04762	%	40.15	52.24	46.8	52.9	58.12	80.66	10-May-1993
93.04764	%	29.8	34.91	56.42	55.6	39.79	76.8	25-May-1993
93.04764	%	25.54	35.36	35.86	41.98	42.4	85.76	25-May-1993
93.04870	%	53.55	66.69	71.66	72.04	95.85	30.18	25-May-1993
93.05027	%	57.14	71.66	63.16	56.92	51.74	86.38	25-May-1993
EPA Limits:								
Water	%	21 - 100	10 - 94	35 - 114	43 - 116	10 - 123	33 - 141	
Soil	%	25 - 121	24 - 113	23 - 120	30 - 115	19 - 122	18 - 137	

REPORT NUMBER: 18672

Analyst: Budgd Burg — Date: 5/26/93
Reviewer — Date: 5/26/93
Section Leader — Date: 5/26/93
QA Officer: mag — Date: 5/26/93

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'ity Assurance for Health and Environmental Chemistry: 1986,' LA-1111' pp. 3-4.

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04845 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-0-0	93.04845	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-0-0	93.04845	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-0-0	93.04845	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-0-0	93.04845	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-0-0	93.04845	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-0-0	93.04845	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-0-0	93.04845	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-0-0	93.04845	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-0-0	93.04845	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-0-0	93.04845	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-0-0	93.04845	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-0-0	93.04845	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-0-0	93.04845	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-0-0	93.04845	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-0-0	93.04845	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-0-0	93.04845	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-0-0	93.04845	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-0-0	93.04845	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-0-0	93.04845	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-0-0	93.04845	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-0-0	93.04845	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-0-0	93.04845	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-0-0	93.04845	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-0-0	93.04845	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-0-0	93.04845	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-0-0	93.04845	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-0-0	93.04845	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-0-0	93.04845	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-0-0	93.04845	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-0-0	93.04845	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-0-0	93.04845	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-0-0	93.04845	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-0-0	93.04845	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-0-0	93.04845	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-0-0	93.04845	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-0-0	93.04845	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-0-0	93.04845	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-0-0	93.04845	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-0-0	93.04845	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-0-0	93.04845	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-0-0	93.04845	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-0-0	93.04845	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-0-0	93.04845	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-0-0	93.04845	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-0-0	93.04845	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-0-0	93.04845	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-0-0	93.04845	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-0-0	93.04845	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-0-0	93.04845	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-0-0	93.04845	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-0-0	93.04845	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-0-0	93.04845	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-0-0	93.04845	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-0-0	93.04845	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-0-0	93.04845	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-0-0	93.04845	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-0-0	93.04845	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-0-0	93.04845	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-0-0	93.04845	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-0-0	93.04845	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-0-0	93.04845	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-0-0	93.04845	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-0-0	93.04845	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-0-0	93.04845	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-0-0	93.04845	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-0-0	93.04845	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04845

none

******************** EM-9 ANALYTICAL REPORT ********************

Matrix Spike Results for Sample # 93.04845 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	83329	1744.42	1300.	UG/KG	5/25/93		Acenaphthene
14-35-0-0	93.04845	59507	3488.84	2300.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-0-0	93.04845	95578	3488.84	2400.	UG/KG	5/25/93		o-Chlorophenol
14-35-0-0	93.04845	106467	1744.42	1100.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-0-0	93.04845	121142	1744.42	1400.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-0-0	93.04845	100027	3488.84	2500.	UG/KG	5/25/93		4-Nitrophenol
14-35-0-0	93.04845	621647	1744.42	1300.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-0-0	93.04845	87865	3488.84	3000.	UG/KG	5/25/93		Pentachlorophenol
14-35-0-0	93.04845	108952	3488.84	2300.	UG/KG	5/25/93		Phenol
14-35-0-0	93.04845	129000	1744.42	1500.	UG/KG	5/25/93		Pyrene
14-35-0-0	93.04845	120821	1744.42	1200.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

Matrix Spike Duplicate Results for Sample # 93.04845 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-0-0	93.04845	83329	1768.22	1200.	UG/KG	5/25/93		Acenaphthene
14-35-0-0	93.04845	59507	3536.44	2200.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-0-0	93.04845	95578	3536.44	1900.	UG/KG	5/25/93		o-Chlorophenol
14-35-0-0	93.04845	106467	1768.22	870.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-0-0	93.04845	121142	1768.22	1300.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-0-0	93.04845	100027	3536.44	2600.	UG/KG	5/25/93		4-Nitrophenol
14-35-0-0	93.04845	621647	1768.22	1100.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-0-0	93.04845	87865	3536.44	2800.	UG/KG	5/25/93		Pentachlorophenol
14-35-0-0	93.04845	108952	3536.44	1900.	UG/KG	5/25/93		Phenol
14-35-0-0	93.04845	129000	1768.22	1500.	UG/KG	5/25/93		Pyrene
14-35-0-0	93.04845	120821	1768.22	950.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04846 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-5	93.04846	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-5	93.04846	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-5	93.04846	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-5	93.04846	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-5	93.04846	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-5	93.04846	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-5	93.04846	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-5	93.04846	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-5	93.04846	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-5	93.04846	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-5	93.04846	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-5	93.04846	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-5	93.04846	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-5	93.04846	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-5	93.04846	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-5	93.04846	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-5	93.04846	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-5	93.04846	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-5	93.04846	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-5	93.04846	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-5	93.04846	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-5	93.04846	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-5	93.04846	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-5	93.04846	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-5	93.04846	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-5	93.04846	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-5	93.04846	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-5	93.04846	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-5	93.04846	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-5	93.04846	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-5	93.04846	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-5	93.04846	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-5	93.04846	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-5	93.04846	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-5	93.04846	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-5	93.04846	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-5	93.04846	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-5	93.04846	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-5	93.04846	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-5	93.04846	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-5	93.04846	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-5	93.04846	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-5	93.04846	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-5	93.04846	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-5	93.04846	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-5	93.04846	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-5	93.04846	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-5	93.04846	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-5	93.04846	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-5	93.04846	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-5	93.04846	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-5	93.04846	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-5	93.04846	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-5	93.04846	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-5	93.04846	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-5	93.04846	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-5	93.04846	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-5	93.04846	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-5	93.04846	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-5	93.04846	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-5	93.04846	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-5	93.04846	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-5	93.04846	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-5	93.04846	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-5	93.04846	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-5	93.04846	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-5	93.04846	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-5	93.04846	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-5	93.04846	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04846

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04847 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10	93.04847	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-10	93.04847	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-10	93.04847	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-10	93.04847	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-10	93.04847	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-10	93.04847	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-10	93.04847	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-10	93.04847	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-10	93.04847	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-10	93.04847	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-10	93.04847	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-10	93.04847	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-10	93.04847	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-10	93.04847	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-10	93.04847	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-10	93.04847	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-10	93.04847	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-10	93.04847	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-10	93.04847	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-10	93.04847	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-10	93.04847	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-10	93.04847	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-10	93.04847	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-10	93.04847	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-10	93.04847	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-10	93.04847	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10	93.04847	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-10	93.04847	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-10	93.04847	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-10	93.04847	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-10	93.04847	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-10	93.04847	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-10	93.04847	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-10	93.04847	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-10	93.04847	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-10	93.04847	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-10	93.04847	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-10	93.04847	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-10	93.04847	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-10	93.04847	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-10	93.04847	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-10	93.04847	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-10	93.04847	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-10	93.04847	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-10	93.04847	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-10	93.04847	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-10	93.04847	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-10	93.04847	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-10	93.04847	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-10	93.04847	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-10	93.04847	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-10	93.04847	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-10	93.04847	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-10	93.04847	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-10	93.04847	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-10	93.04847	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-10	93.04847	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-10	93.04847	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-10	93.04847	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-10	93.04847	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-10	93.04847	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-10	93.04847	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10	93.04847	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-10	93.04847	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-10	93.04847	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-10	93.04847	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-10	93.04847	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-10	93.04847	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-10	93.04847	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04847

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04848 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-25	93.04848	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-25	93.04848	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-25	93.04848	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-25	93.04848	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-25	93.04848	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-25	93.04848	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-25	93.04848	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-25	93.04848	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-25	93.04848	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-25	93.04848	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-25	93.04848	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-25	93.04848	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-25	93.04848	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-25	93.04848	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-25	93.04848	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-25	93.04848	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-25	93.04848	117817	690.	207.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-25	93.04848	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-25	93.04848	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-25	93.04848	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-25	93.04848	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-25	93.04848	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-25	93.04848	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-25	93.04848	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-25	93.04848	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-25	93.04848	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-25	93.04848	117840	690.	207.	UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-25	93.04848	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-25	93.04848	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-25	93.04848	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-25	93.04848	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-25	93.04848	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-25	93.04848	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-25	93.04848	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-25	93.04848	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-25	93.04848	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-25	93.04848	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-25	93.04848	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-25	93.04848	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-25	93.04848	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-25	93.04848	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-25	93.04848	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-25	93.04848	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-25	93.04848	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-25	93.04848	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-25	93.04848	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-25	93.04848	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-25	93.04848	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-25	93.04848	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-25	93.04848	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-25	93.04848	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-25	93.04848	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-25	93.04848	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-25	93.04848	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-25	93.04848	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-25	93.04848	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-25	93.04848	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-25	93.04848	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-25	93.04848	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-25	93.04848	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-25	93.04848	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-25	93.04848	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-25	93.04848	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-25	93.04848	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-25	93.04848	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-25	93.04848	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-25	93.04848	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-25	93.04848	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-25	93.04848	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04848

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04849 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-50	93.04849	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-50	93.04849	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-50	93.04849	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-50	93.04849	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-50	93.04849	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-50	93.04849	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-50	93.04849	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-50	93.04849	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-50	93.04849	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-50	93.04849	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-50	93.04849	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-50	93.04849	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-50	93.04849	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-50	93.04849	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-50	93.04849	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-50	93.04849	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-50	93.04849	117817	1100.	330.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-50	93.04849	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-50	93.04849	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-50	93.04849	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-50	93.04849	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-50	93.04849	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-50	93.04849	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-50	93.04849	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-50	93.04849	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-50	93.04849	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************** EM-9 ANALYTICAL REPORT **********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-50	93.04849	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-50	93.04849	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-50	93.04849	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-50	93.04849	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-50	93.04849	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-50	93.04849	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-50	93.04849	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-50	93.04849	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-50	93.04849	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-50	93.04849	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-50	93.04849	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-50	93.04849	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-50	93.04849	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-50	93.04849	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-50	93.04849	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-50	93.04849	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-50	93.04849	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-50	93.04849	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-50	93.04849	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-50	93.04849	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-50	93.04849	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-50	93.04849	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-50	93.04849	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-50	93.04849	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-50	93.04849	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-50	93.04849	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-50	93.04849	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-50	93.04849	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-50	93.04849	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-50	93.04849	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-50	93.04849	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-50	93.04849	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-50	93.04849	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-50	93.04849	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-50	93.04849	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-50	93.04849	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-50	93.04849	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-50	93.04849	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-50	93.04849	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-50	93.04849	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-50	93.04849	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-50	93.04849	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-50	93.04849	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04849

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04850 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-100	93.04850	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-100	93.04850	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-100	93.04850	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-100	93.04850	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-100	93.04850	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-100	93.04850	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-100	93.04850	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-100	93.04850	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-100	93.04850	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-100	93.04850	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-100	93.04850	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-100	93.04850	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-100	93.04850	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-100	93.04850	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-100	93.04850	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-100	93.04850	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-100	93.04850	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-100	93.04850	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-100	93.04850	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-100	93.04850	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-100	93.04850	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-100	93.04850	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-100	93.04850	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-100	93.04850	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-100	93.04850	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-100	93.04850	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-100	93.04850	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-100	93.04850	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-100	93.04850	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-100	93.04850	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-100	93.04850	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-100	93.04850	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-100	93.04850	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-100	93.04850	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-100	93.04850	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-100	93.04850	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-100	93.04850	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-100	93.04850	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-100	93.04850	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-100	93.04850	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-100	93.04850	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-100	93.04850	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-100	93.04850	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-100	93.04850	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-100	93.04850	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-100	93.04850	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-100	93.04850	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-100	93.04850	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-100	93.04850	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-100	93.04850	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-100	93.04850	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-100	93.04850	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-100	93.04850	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-100	93.04850	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-100	93.04850	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-100	93.04850	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-100	93.04850	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-100	93.04850	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-100	93.04850	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-100	93.04850	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-100	93.04850	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-100	93.04850	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-100	93.04850	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-100	93.04850	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-100	93.04850	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-100	93.04850	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-100	93.04850	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-100	93.04850	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-100	93.04850	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04850

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04851 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10R	93.04851	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-E-10R	93.04851	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-E-10R	93.04851	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-E-10R	93.04851	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-E-10R	93.04851	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-E-10R	93.04851	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-E-10R	93.04851	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-E-10R	93.04851	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-E-10R	93.04851	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-E-10R	93.04851	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-E-10R	93.04851	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-E-10R	93.04851	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-E-10R	93.04851	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-E-10R	93.04851	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-E-10R	93.04851	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-E-10R	93.04851	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-E-10R	93.04851	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-E-10R	93.04851	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-E-10R	93.04851	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-E-10R	93.04851	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-E-10R	93.04851	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-E-10R	93.04851	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-E-10R	93.04851	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-E-10R	93.04851	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-E-10R	93.04851	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-E-10R	93.04851	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10R	93.04851	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-E-10R	93.04851	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-E-10R	93.04851	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-E-10R	93.04851	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-E-10R	93.04851	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-E-10R	93.04851	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-E-10R	93.04851	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-E-10R	93.04851	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-E-10R	93.04851	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-E-10R	93.04851	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-E-10R	93.04851	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-E-10R	93.04851	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-E-10R	93.04851	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-E-10R	93.04851	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-E-10R	93.04851	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-E-10R	93.04851	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-E-10R	93.04851	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-E-10R	93.04851	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-E-10R	93.04851	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-E-10R	93.04851	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-E-10R	93.04851	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-E-10R	93.04851	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-E-10R	93.04851	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-E-10R	93.04851	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-E-10R	93.04851	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-E-10R	93.04851	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-E-10R	93.04851	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-E-10R	93.04851	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-E-10R	93.04851	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-E-10R	93.04851	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-E-10R	93.04851	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-E-10R	93.04851	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-E-10R	93.04851	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-E-10R	93.04851	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-E-10R	93.04851	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-E-10R	93.04851	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-E-10R	93.04851	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-E-10R	93.04851	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-E-10R	93.04851	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-E-10R	93.04851	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-E-10R	93.04851	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-E-10R	93.04851	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-E-10R	93.04851	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04851

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04852 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-5	93.04852	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-5	93.04852	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-5	93.04852	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-5	93.04852	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-5	93.04852	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-5	93.04852	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-5	93.04852	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-5	93.04852	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-5	93.04852	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-5	93.04852	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-5	93.04852	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-5	93.04852	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-5	93.04852	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-5	93.04852	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-5	93.04852	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-5	93.04852	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-5	93.04852	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-5	93.04852	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-5	93.04852	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-5	93.04852	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-5	93.04852	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-5	93.04852	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-5	93.04852	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-5	93.04852	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-5	93.04852	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-5	93.04852	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-5	93.04852	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-5	93.04852	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-5	93.04852	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-5	93.04852	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-5	93.04852	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-5	93.04852	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-5	93.04852	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-5	93.04852	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-5	93.04852	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-5	93.04852	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-5	93.04852	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-5	93.04852	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-5	93.04852	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-5	93.04852	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-5	93.04852	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-5	93.04852	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-5	93.04852	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-5	93.04852	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-5	93.04852	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-5	93.04852	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-5	93.04852	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-5	93.04852	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-5	93.04852	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-5	93.04852	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-5	93.04852	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-5	93.04852	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-5	93.04852	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-5	93.04852	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-5	93.04852	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-5	93.04852	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-5	93.04852	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-5	93.04852	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-5	93.04852	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-5	93.04852	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-5	93.04852	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-5	93.04852	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-5	93.04852	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-5	93.04852	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-5	93.04852	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-5	93.04852	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-5	93.04852	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-5	93.04852	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-5	93.04852	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04852

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04853 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-10	93.04853	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-10	93.04853	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-10	93.04853	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-10	93.04853	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-10	93.04853	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-10	93.04853	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-10	93.04853	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-10	93.04853	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-10	93.04853	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-10	93.04853	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-10	93.04853	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-10	93.04853	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-10	93.04853	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-10	93.04853	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-10	93.04853	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-10	93.04853	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-10	93.04853	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-10	93.04853	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-10	93.04853	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-10	93.04853	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-10	93.04853	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-10	93.04853	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-10	93.04853	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-10	93.04853	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-10	93.04853	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-10	93.04853	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-10	93.04853	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-10	93.04853	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-10	93.04853	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-10	93.04853	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-10	93.04853	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-10	93.04853	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-10	93.04853	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-10	93.04853	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-10	93.04853	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-10	93.04853	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-10	93.04853	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-10	93.04853	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-10	93.04853	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-10	93.04853	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-10	93.04853	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-10	93.04853	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-10	93.04853	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-10	93.04853	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-10	93.04853	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-10	93.04853	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-10	93.04853	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-10	93.04853	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-10	93.04853	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-10	93.04853	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-10	93.04853	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-10	93.04853	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-10	93.04853	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-10	93.04853	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-10	93.04853	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-10	93.04853	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-10	93.04853	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-10	93.04853	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-10	93.04853	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-10	93.04853	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-10	93.04853	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-10	93.04853	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-10	93.04853	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-10	93.04853	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-10	93.04853	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-10	93.04853	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-10	93.04853	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-10	93.04853	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-10	93.04853	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04853

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04854 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-25	93.04854	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-25	93.04854	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-25	93.04854	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-25	93.04854	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-25	93.04854	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-25	93.04854	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-25	93.04854	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-25	93.04854	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-25	93.04854	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-25	93.04854	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-25	93.04854	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-25	93.04854	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-25	93.04854	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-25	93.04854	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-25	93.04854	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-25	93.04854	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-25	93.04854	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-25	93.04854	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-25	93.04854	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-25	93.04854	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-25	93.04854	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-25	93.04854	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-25	93.04854	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-25	93.04854	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-25	93.04854	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-25	93.04854	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-25	93.04854	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-25	93.04854	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-25	93.04854	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-25	93.04854	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-25	93.04854	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-25	93.04854	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-25	93.04854	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-25	93.04854	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-25	93.04854	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-25	93.04854	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-25	93.04854	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-25	93.04854	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-25	93.04854	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-25	93.04854	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-25	93.04854	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-25	93.04854	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-25	93.04854	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-25	93.04854	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-25	93.04854	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-25	93.04854	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-25	93.04854	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-25	93.04854	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-25	93.04854	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-25	93.04854	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-25	93.04854	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-25	93.04854	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-25	93.04854	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-25	93.04854	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-25	93.04854	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-25	93.04854	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-25	93.04854	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-25	93.04854	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-25	93.04854	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-25	93.04854	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-25	93.04854	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-25	93.04854	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-25	93.04854	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-25	93.04854	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-25	93.04854	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-25	93.04854	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-25	93.04854	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-25	93.04854	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-25	93.04854	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04854

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04855 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-50	93.04855	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-50	93.04855	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-50	93.04855	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-50	93.04855	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-50	93.04855	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-50	93.04855	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-50	93.04855	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-50	93.04855	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-50	93.04855	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-50	93.04855	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-50	93.04855	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-50	93.04855	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-50	93.04855	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-50	93.04855	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-50	93.04855	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-50	93.04855	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-50	93.04855	117817	870.	261.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-50	93.04855	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-50	93.04855	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-50	93.04855	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-50	93.04855	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-50	93.04855	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-50	93.04855	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-50	93.04855	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-50	93.04855	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-50	93.04855	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-50	93.04855	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-50	93.04855	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-50	93.04855	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-50	93.04855	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-50	93.04855	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-50	93.04855	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-50	93.04855	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-50	93.04855	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-50	93.04855	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-50	93.04855	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-50	93.04855	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-50	93.04855	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-50	93.04855	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-50	93.04855	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-50	93.04855	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-50	93.04855	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-50	93.04855	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-50	93.04855	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-50	93.04855	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-50	93.04855	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-50	93.04855	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-50	93.04855	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-50	93.04855	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-50	93.04855	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-50	93.04855	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-50	93.04855	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-50	93.04855	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-50	93.04855	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-50	93.04855	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-50	93.04855	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-50	93.04855	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-50	93.04855	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-50	93.04855	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-50	93.04855	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-50	93.04855	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-50	93.04855	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-50	93.04855	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-50	93.04855	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-50	93.04855	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-50	93.04855	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-50	93.04855	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-50	93.04855	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-50	93.04855	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04855

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04856 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-100	93.04856	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SE-100	93.04856	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SE-100	93.04856	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SE-100	93.04856	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SE-100	93.04856	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SE-100	93.04856	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SE-100	93.04856	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SE-100	93.04856	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SE-100	93.04856	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SE-100	93.04856	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SE-100	93.04856	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SE-100	93.04856	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SE-100	93.04856	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SE-100	93.04856	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SE-100	93.04856	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SE-100	93.04856	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SE-100	93.04856	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SE-100	93.04856	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SE-100	93.04856	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SE-100	93.04856	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SE-100	93.04856	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SE-100	93.04856	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SE-100	93.04856	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SE-100	93.04856	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SE-100	93.04856	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SE-100	93.04856	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-100	93.04856	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SE-100	93.04856	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SE-100	93.04856	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SE-100	93.04856	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SE-100	93.04856	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SE-100	93.04856	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SE-100	93.04856	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SE-100	93.04856	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SE-100	93.04856	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SE-100	93.04856	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SE-100	93.04856	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SE-100	93.04856	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SE-100	93.04856	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SE-100	93.04856	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SE-100	93.04856	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SE-100	93.04856	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SE-100	93.04856	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SE-100	93.04856	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SE-100	93.04856	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SE-100	93.04856	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SE-100	93.04856	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SE-100	93.04856	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SE-100	93.04856	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SE-100	93.04856	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SE-100	93.04856	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SE-100	93.04856	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SE-100	93.04856	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SE-100	93.04856	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SE-100	93.04856	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SE-100	93.04856	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SE-100	93.04856	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SE-100	93.04856	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SE-100	93.04856	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SE-100	93.04856	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SE-100	93.04856	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SE-100	93.04856	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SE-100	93.04856	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SE-100	93.04856	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SE-100	93.04856	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SE-100	93.04856	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SE-100	93.04856	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SE-100	93.04856	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SE-100	93.04856	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04856

none

********************** EM-9 ANALYTICAL REPORT **********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04857 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-5	93.04857	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-5	93.04857	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-5	93.04857	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-5	93.04857	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-5	93.04857	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-5	93.04857	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-5	93.04857	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-5	93.04857	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-5	93.04857	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-5	93.04857	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-5	93.04857	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-5	93.04857	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-5	93.04857	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-5	93.04857	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-5	93.04857	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-5	93.04857	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-5	93.04857	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-5	93.04857	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-5	93.04857	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-5	93.04857	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-5	93.04857	106478	[illegible]30.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-5	93.04857	91587	[illegible]0.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-5	93.04857	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-5	93.04857	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-5	93.04857	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-5	93.04857	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-5	93.04857	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-5	93.04857	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-5	93.04857	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-5	93.04857	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-5	93.04857	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-5	93.04857	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-5	93.04857	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-5	93.04857	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-5	93.04857	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-5	93.04857	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-5	93.04857	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-5	93.04857	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-5	93.04857	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-5	93.04857	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-5	93.04857	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-5	93.04857	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-5	93.04857	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-5	93.04857	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-5	93.04857	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-5	93.04857	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-5	93.04857	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-5	93.04857	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-5	93.04857	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-5	93.04857	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-5	93.04857	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-5	93.04857	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-5	93.04857	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-5	93.04857	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-5	93.04857	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-5	93.04857	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-5	93.04857	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-5	93.04857	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-5	93.04857	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-5	93.04857	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-5	93.04857	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-5	93.04857	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-5	93.04857	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-5	93.04857	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-5	93.04857	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-5	93.04857	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-5	93.04857	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-5	93.04857	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-5	93.04857	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04857

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04858 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/12/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-10	93.04858	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-10	93.04858	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-10	93.04858	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-10	93.04858	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-10	93.04858	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-10	93.04858	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-10	93.04858	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-10	93.04858	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-10	93.04858	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-10	93.04858	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-10	93.04858	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-10	93.04858	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-10	93.04858	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-10	93.04858	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-10	93.04858	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-10	93.04858	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-10	93.04858	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-10	93.04858	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-10	93.04858	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-10	93.04858	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-10	93.04858	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-10	93.04858	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-10	93.04858	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-10	93.04858	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-10	93.04858	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-10	93.04858	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-10	93.04858	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-10	93.04858	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-10	93.04858	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-10	93.04858	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-10	93.04858	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-10	93.04858	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-10	93.04858	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-10	93.04858	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-10	93.04858	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-10	93.04858	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-10	93.04858	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-10	93.04858	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-10	93.04858	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-10	93.04858	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-10	93.04858	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-10	93.04858	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-10	93.04858	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-10	93.04858	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-10	93.04858	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-10	93.04858	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-10	93.04858	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-10	93.04858	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-10	93.04858	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-10	93.04858	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-10	93.04858	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-10	93.04858	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-10	93.04858	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-10	93.04858	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-10	93.04858	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-10	93.04858	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-10	93.04858	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-10	93.04858	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-10	93.04858	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-10	93.04858	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-10	93.04858	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-10	93.04858	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-10	93.04858	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-10	93.04858	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-10	93.04858	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-10	93.04858	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-10	93.04858	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-10	93.04858	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-10	93.04858	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04858

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04859 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/12/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-25	93.04859	83329	< 3300.		UG/KG	5/25/93		Acenaphthene
14-35-SW-25	93.04859	208968	< 3300.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-25	93.04859	62533	< 3300.		UG/KG	5/25/93		Aniline
14-35-SW-25	93.04859	120127	< 3300.		UG/KG	5/25/93		Anthracene
14-35-SW-25	93.04859	103333	< 3300.		UG/KG	5/25/93		Azobenzene
14-35-SW-25	93.04859	92875	< 3300.		UG/KG	5/25/93		m-Benzidine
14-35-SW-25	93.04859	56553	< 3300.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-25	93.04859	50328	< 3300.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-25	93.04859	205992	< 3300.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-25	93.04859	191242	< 3300.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-25	93.04859	207089	< 3300.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-25	93.04859	65850	< 3300.		UG/KG	5/25/93		Benzoic acid
14-35-SW-25	93.04859	100516	< 3300.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-25	93.04859	111911	< 3300.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-25	93.04859	111444	< 3300.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-25	93.04859	108601	< 3300.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-25	93.04859	117817	< 3300.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-25	93.04859	101553	< 3300.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-25	93.04859	85687	< 3300.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-25	93.04859	59507	< 3300.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-25	93.04859	106478	< 3300.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-25	93.04859	91587	< 3300.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-25	93.04859	95578	< 3300.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-25	93.04859	7005723	< 3300.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-25	93.04859	218019	< 3300.		UG/KG	5/25/93		Chrysene
14-35-SW-25	93.04859	84742	< 3300.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-25	93.04859	117840	< 3300.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-25	93.04859	53703	< 3300.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-25	93.04859	132649	< 3300.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-25	93.04859	95501	< 3300.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-25	93.04859	541731	< 3300.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-25	93.04859	106467	< 3300.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-25	93.04859	91941	< 3300.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-25	93.04859	120832	< 3300.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-25	93.04859	84662	< 3300.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-25	93.04859	131113	< 3300.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-25	93.04859	105679	< 3300.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-25	93.04859	51285	< 3300.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-25	93.04859	121142	< 3300.		UG/KG	5/25/		2,4-Dinitrotoluene
14-35-SW-25	93.04859	606202	< 3300.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-25	93.04859	206440	< 3300.		UG/KG	5/25/93		Fluoranthene
14-35-SW-25	93.04859	86737	< 3300.		UG/KG	5/25/93		Fluorene
14-35-SW-25	93.04859	118741	< 3300.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-25	93.04859	87683	< 3300.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-25	93.04859	77474	< 3300.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-25	93.04859	67721	< 3300.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-25	93.04859	193395	< 3300.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-25	93.04859	78591	< 3300.		UG/KG	5/25/93		Isophorone
14-35-SW-25	93.04859	534521	< 3300.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-25	93.04859	91576	< 3300.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-25	93.04859	95487	< 3300.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-25	93.04859	106445	< 3300.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-25	93.04859	91203	< 3300.		UG/KG	5/25/93		Naphthalene
14-35-SW-25	93.04859	88744	< 3300.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-25	93.04859	99092	< 3300.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-25	93.04859	100016	< 3300.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-25	93.04859	98953	< 3300.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-25	93.04859	88755	< 3300.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-25	93.04859	100027	< 3300.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-25	93.04859	621647	< 3300.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-25	93.04859	62759	< 3300.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-25	93.04859	86306	< 3300.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************** EM-9 ANALYTICAL REPORT **********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-25	93.04859	87865	< 3300.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-25	93.04859	85018	< 3300.		UG/KG	5/25/93		Phenanthrene
14-35-SW-25	93.04859	108952	< 3300.		UG/KG	5/25/93		Phenol
14-35-SW-25	93.04859	129000	< 3300.		UG/KG	5/25/93		Pyrene
14-35-SW-25	93.04859	120821	< 3300.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-25	93.04859	95954	< 3300.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-25	93.04859	88062	< 3300.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04859

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04860 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-50	93.04860	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-50	93.04860	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-50	93.04860	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-50	93.04860	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-50	93.04860	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-50	93.04860	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-50	93.04860	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-50	93.04860	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-50	93.04860	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-50	93.04860	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-50	93.04860	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-50	93.04860	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-50	93.04860	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-50	93.04860	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-50	93.04860	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-50	93.04860	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-50	93.04860	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-50	93.04860	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-50	93.04860	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-50	93.04860	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-50	93.04860	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-50	93.04860	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-50	93.04860	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-50	93.04860	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-50	93.04860	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-50	93.04860	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-50	93.04860	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-50	93.04860	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-50	93.04860	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-50	93.04860	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-50	93.04860	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-50	93.04860	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-50	93.04860	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-50	93.04860	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-50	93.04860	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-50	93.04860	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-50	93.04860	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-50	93.04860	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-50	93.04860	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-50	93.04860	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-50	93.04860	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-50	93.04860	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-50	93.04860	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-50	93.04860	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-50	93.04860	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-50	93.04860	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-50	93.04860	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-50	93.04860	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-50	93.04860	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-50	93.04860	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-50	93.04860	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-50	93.04860	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-50	93.04860	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-50	93.04860	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-50	93.04860	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-50	93.04860	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-50	93.04860	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-50	93.04860	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-50	93.04860	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-50	93.04860	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-50	93.04860	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-50	93.04860	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-50	93.04860	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-50	93.04860	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-50	93.04860	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-50	93.04860	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-50	93.04860	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-50	93.04860	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-50	93.04860	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04860

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04861 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-100	93.04861	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-SW-100	93.04861	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-SW-100	93.04861	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-SW-100	93.04861	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-SW-100	93.04861	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-SW-100	93.04861	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-SW-100	93.04861	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-SW-100	93.04861	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-SW-100	93.04861	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-SW-100	93.04861	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-SW-100	93.04861	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-SW-100	93.04861	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-SW-100	93.04861	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-SW-100	93.04861	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-SW-100	93.04861	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-SW-100	93.04861	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-SW-100	93.04861	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-SW-100	93.04861	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-SW-100	93.04861	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-SW-100	93.04861	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-SW-100	93.04861	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-SW-100	93.04861	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-SW-100	93.04861	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-SW-100	93.04861	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-SW-100	93.04861	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-SW-100	93.04861	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-100	93.04861	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-SW-100	93.04861	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-SW-100	93.04861	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-SW-100	93.04861	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-SW-100	93.04861	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-SW-100	93.04861	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-SW-100	93.04861	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-SW-100	93.04861	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-SW-100	93.04861	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-SW-100	93.04861	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-SW-100	93.04861	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-SW-100	93.04861	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-SW-100	93.04861	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-SW-100	93.04861	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-SW-100	93.04861	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-SW-100	93.04861	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-SW-100	93.04861	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-SW-100	93.04861	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-SW-100	93.04861	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-SW-100	93.04861	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-SW-100	93.04861	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-SW-100	93.04861	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-SW-100	93.04861	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-SW-100	93.04861	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-SW-100	93.04861	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-SW-100	93.04861	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-SW-100	93.04861	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-SW-100	93.04861	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-SW-100	93.04861	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-SW-100	93.04861	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-SW-100	93.04861	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-SW-100	93.04861	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-SW-100	93.04861	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-SW-100	93.04861	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-SW-100	93.04861	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-SW-100	93.04861	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-SW-100	93.04861	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-SW-100	93.04861	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-SW-100	93.04861	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-SW-100	93.04861	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-SW-100	93.04861	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-SW-100	93.04861	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-SW-100	93.04861	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04861

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04862 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-5	93.04862	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-5	93.04862	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-5	93.04862	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-5	93.04862	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-5	93.04862	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-5	93.04862	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-5	93.04862	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-5	93.04862	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-5	93.04862	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-5	93.04862	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-5	93.04862	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-5	93.04862	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-5	93.04862	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-5	93.04862	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-5	93.04862	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-5	93.04862	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-5	93.04862	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-5	93.04862	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-5	93.04862	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-5	93.04862	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-5	93.04862	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-5	93.04862	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-5	93.04862	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-5	93.04862	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-5	93.04862	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-5	93.04862	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-5	93.04862	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-5	93.04862	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-5	93.04862	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-5	93.04862	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-5	93.04862	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-5	93.04862	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-5	93.04862	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-5	93.04862	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-5	93.04862	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-5	93.04862	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-5	93.04862	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-5	93.04862	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-5	93.04862	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-5	93.04862	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-5	93.04862	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-5	93.04862	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-5	93.04862	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-5	93.04862	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-5	93.04862	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-5	93.04862	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-5	93.04862	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-5	93.04862	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-5	93.04862	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-5	93.04862	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-5	93.04862	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-5	93.04862	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-5	93.04862	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-5	93.04862	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-5	93.04862	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-5	93.04862	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-5	93.04862	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S	93.04862	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-5	93.04862	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-5	93.04862	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-5	93.04862	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-5	93.04862	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************** EM-9 ANALYTICAL REPORT **********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-5	93.04862	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-5	93.04862	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-5	93.04862	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-5	93.04862	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-5	93.04862	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-5	93.04862	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-5	93.04862	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04862

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04863 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10	93.04863	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-10	93.04863	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-10	93.04863	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-10	93.04863	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-10	93.04863	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-10	93.04863	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-10	93.04863	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-10	93.04863	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-10	93.04863	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-10	93.04863	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-10	93.04863	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-10	93.04863	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-10	93.04863	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-10	93.04863	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-10	93.04863	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-10	93.04863	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-10	93.04863	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-10	93.04863	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-10	93.04863	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-10	93.04863	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-10	93.04863	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-10	93.04863	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-10	93.04863	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-10	93.04863	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-10	93.04863	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-10	93.04863	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10	93.04863	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-10	93.04863	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-10	93.04863	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-10	93.04863	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-10	93.04863	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-10	93.04863	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-10	93.04863	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-10	93.04863	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-10	93.04863	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-10	93.04863	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-10	93.04863	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-10	93.04863	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-10	93.04863	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-10	93.04863	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-10	93.04863	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-10	93.04863	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-10	93.04863	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-10	93.04863	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-10	93.04863	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-10	93.04863	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-10	93.04863	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-10	93.04863	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-10	93.04863	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-10	93.04863	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-10	93.04863	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-10	93.04863	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-10	93.04863	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-10	93.04863	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-10	93.04863	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-10	93.04863	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-10	93.04863	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S-10	93.04863	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-10	93.04863	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-10	93.04863	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-10	93.04863	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-10	93.04863	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10	93.04863	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-10	93.04863	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-10	93.04863	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-10	93.04863	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-10	93.04863	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-10	93.04863	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-10	93.04863	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04863

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04864 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/03/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-25	93.04864	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-25	93.04864	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-25	93.04864	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-25	93.04864	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-25	93.04864	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-25	93.04864	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-25	93.04864	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-25	93.04864	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-25	93.04864	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-25	93.04864	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-25	93.04864	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-25	93.04864	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-25	93.04864	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-25	93.04864	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-25	93.04864	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-25	93.04864	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-25	93.04864	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-25	93.04864	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-25	93.04864	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-25	93.04864	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-25	93.04864	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-25	93.04864	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-25	93.04864	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-25	93.04864	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-25	93.04864	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-25	93.04864	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-25	93.04864	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-25	93.04864	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-25	93.04864	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-25	93.04864	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-25	93.04864	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-25	93.04864	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-25	93.04864	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-25	93.04864	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-25	93.04864	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-25	93.04864	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-25	93.04864	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-25	93.04864	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-25	93.04864	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-25	93.04864	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-25	93.04864	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-25	93.04864	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-25	93.04864	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-25	93.04864	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-25	93.04864	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-25	93.04864	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-25	93.04864	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-25	93.04864	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-25	93.04864	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-25	93.04864	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-25	93.04864	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-25	93.04864	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-25	93.04864	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-25	93.04864	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-25	93.04864	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-25	93.04864	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-25	93.04864	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S-25	93.04864	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-25	93.04864	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-25	93.04864	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-25	93.04864	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-25	93.04864	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-25	93.04864	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-25	93.04864	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-25	93.04864	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-25	93.04864	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-25	93.04864	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-25	93.04864	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-25	93.04864	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04864

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04865 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	83329	< 3300.		UG/KG	5/25/93		Acenaphthene
14-35-S-50	93.04865	208968	< 3300.		UG/KG	5/25/93		Acenaphthylene
14-35-S-50	93.04865	62533	< 3300.		UG/KG	5/25/93		Aniline
14-35-S-50	93.04865	120127	< 3300.		UG/KG	5/25/93		Anthracene
14-35-S-50	93.04865	103333	< 3300.		UG/KG	5/25/93		Azobenzene
14-35-S-50	93.04865	92875	< 3300.		UG/KG	5/25/93		m-Benzidine
14-35-S-50	93.04865	56553	< 3300.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-50	93.04865	50328	< 3300.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-50	93.04865	205992	< 3300.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-50	93.04865	191242	< 3300.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-50	93.04865	207089	< 3300.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-50	93.04865	65850	< 3300.		UG/KG	5/25/93		Benzoic acid
14-35-S-50	93.04865	100516	< 3300.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-50	93.04865	111911	< 3300.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-50	93.04865	111444	< 3300.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-50	93.04865	108601	< 3300.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-50	93.04865	117817	< 3300.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-50	93.04865	101553	< 3300.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-50	93.04865	85687	< 3300.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-50	93.04865	59507	< 3300.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-50	93.04865	106478	< 3300.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-50	93.04865	91587	< 3300.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-50	93.04865	95578	< 3300.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-50	93.04865	7005723	< 3300.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-50	93.04865	218019	< 3300.		UG/KG	5/25/93		Chrysene
14-35-S-50	93.04865	84742	< 3300.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	117840	< 3300.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-50	93.04865	53703	< 3300.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-50	93.04865	132649	< 3300.		UG/KG	5/25/93		Dibenzofuran
14-35-S-50	93.04865	95501	< 3300.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-50	93.04865	541731	< 3300.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-50	93.04865	106467	< 3300.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-50	93.04865	91941	< 3300.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-50	93.04865	120832	< 3300.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-50	93.04865	84662	< 3300.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-50	93.04865	131113	< 3300.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-50	93.04865	105679	< 3300.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-50	93.04865	51285	< 3300.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-50	93.04865	121142	< 3300.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-50	93.04865	606202	< 3300.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-50	93.04865	206440	< 3300.		UG/KG	5/25/93		Fluoranthene
14-35-S-50	93.04865	86737	< 3300.		UG/KG	5/25/93		Fluorene
14-35-S-50	93.04865	118741	< 3300.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-50	93.04865	87683	< 3300.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-50	93.04865	77474	< 3300.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-50	93.04865	67721	< 3300.		UG/KG	5/25/93		Hexachloroethane
14-35-S-50	93.04865	193395	< 3300.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-50	93.04865	78591	< 3300.		UG/KG	5/25/93		Isophorone
14-35-S-50	93.04865	534521	< 3300.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-50	93.04865	91576	< 3300.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-50	93.04865	95487	< 3300.		UG/KG	5/25/93		2-Methylphenol
14-35-S-50	93.04865	106445	< 3300.		UG/KG	5/25/93		4-Methylphenol
14-35-S-50	93.04865	91203	< 3300.		UG/KG	5/25/93		Naphthalene
14-35-S-50	93.04865	88744	< 3300.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-50	93.04865	99092	< 3300.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-50	93.04865	100016	< 3300.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-50	93.04865	98953	< 3300.		UG/KG	5/25/93		Nitrobenzene
14-35-S-50	93.04865	88755	< 3300.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-50	93.04865	100027	< 3300.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-50	93.04865	621647	< 3300.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-50	93.04865	62759	< 3300.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-50	93.04865	86306	< 3300.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* LM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	87865	< 3300.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-50	93.04865	85018	< 3300.		UG/KG	5/25/93		Phenanthrene
14-35-S-50	93.04865	108952	< 3300.		UG/KG	5/25/93		Phenol
14-35-S-50	93.04865	129000	3800.	1140.	UG/KG	5/25/93		Pyrene
14-35-S-50	93.04865	120821	< 3300.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-50	93.04865	95954	< 3300.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-50	93.04865	88062	< 3300.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04865

none

********************* EM-9 ANALYTICAL REPORT *********************

Matrix Spike Results for Sample # 93.04865 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	83329	< 1790.07	3300.	UG/KG	5/25/93		Acenaphthene
14-35-S-50	93.04865	59507	< 3580.14	3300.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-50	93.04865	95578	< 3580.14	3300.	UG/KG	5/25/93		o-Chlorophenol
14-35-S-50	93.04865	106467	< 1790.07	3300.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-50	93.04865	121142	< 1790.07	3300.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-50	93.04865	100027	< 3580.14	3300.	UG/KG	5/25/93		4-Nitrophenol
14-35-S-50	93.04865	621647	< 1790.07	3300.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-50	93.04865	87865	< 3580.14	3300.	UG/KG	5/25/93		Pentachlorophenol
14-35-S-50	93.04865	108952	< 3580.14	3300.	UG/KG	5/25/93		Phenol
14-35-S-50	93.04865	129000	< 1790.07	3300.	UG/KG	5/25/93		Pyrene
14-35-S-50	93.04865	120821	< 1790.07	3300.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

Matrix Spike Duplicate Results for Sample # 93.04865 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-50	93.04865	83329	< 1818.64	3300.	UG/KG	5/25/93		Acenaphthene
14-35-S-50	93.04865	59507	< 3637.27	3300.	UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-50	93.04865	95578	< 3637.27	3300.	UG/KG	5/25/93		o-Chlorophenol
14-35-S-50	93.04865	106467	< 1818.64	3300.	UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-50	93.04865	121142	< 1818.64	3300.	UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-50	93.04865	100027	< 3637.27	3300.	UG/KG	5/25/93		4-Nitrophenol
14-35-S-50	93.04865	621647	< 1818.64	3300.	UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-50	93.04865	87865	< 3637.27	3300.	UG/KG	5/25/93		Pentachlorophenol
14-35-S-50	93.04865	108952	< 3637.27	3300.	UG/KG	5/25/93		Phenol
14-35-S-50	93.04865	129000	< 1818.64	3300.	UG/KG	5/25/93		Pyrene
14-35-S-50	93.04865	120821	< 1818.64	3300.	UG/KG	5/25/93		1,2,4-Trichlorobenzene

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04866 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/04/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10R	93.04866	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-S-10R	93.04866	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-S-10R	93.04866	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-S-10R	93.04866	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-S-10R	93.04866	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-S-10R	93.04866	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-S-10R	93.04866	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-10R	93.04866	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-10R	93.04866	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-10R	93.04866	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-10R	93.04866	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-10R	93.04866	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-S-10R	93.04866	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-10R	93.04866	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-10R	93.04866	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-10R	93.04866	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-10R	93.04866	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-10R	93.04866	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-10R	93.04866	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-10R	93.04866	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-10R	93.04866	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-10R	93.04866	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-10R	93.04866	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-10R	93.04866	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-10R	93.04866	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-S-10R	93.04866	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10R	93.04866	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-10R	93.04866	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-10R	93.04866	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-S-10R	93.04866	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-10R	93.04866	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-10R	93.04866	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-10R	93.04866	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-10R	93.04866	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-10R	93.04866	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-10R	93.04866	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-10R	93.04866	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-10R	93.04866	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-10R	93.04866	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-10R	93.04866	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-10R	93.04866	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-S-10R	93.04866	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-S-10R	93.04866	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-10R	93.04866	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-10R	93.04866	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-10R	93.04866	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-S-10R	93.04866	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-10R	93.04866	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-S-10R	93.04866	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-10R	93.04866	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-10R	93.04866	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-S-10R	93.04866	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-S-10R	93.04866	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-S-10R	93.04866	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-10R	93.04866	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-10R	93.04866	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-10R	93.04866	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-S-10R	93.04866	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-10R	93.04866	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-10R	93.04866	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-10R	93.04866	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-10R	93.04866	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

******************** EM-9 ANALYTICAL REPORT ********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-10R	93.04866	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-10R	93.04866	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-S-10R	93.04866	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-S-10R	93.04866	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-S-10R	93.04866	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-10R	93.04866	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-10R	93.04866	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04866

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04867 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-100	93.04867	83329	< 3300.		UG/KG	5/25/93		Acenaphthene
14-35-S-100	93.04867	208968	< 3300.		UG/KG	5/25/93		Acenaphthylene
14-35-S-100	93.04867	62533	< 3300.		UG/KG	5/25/93		Aniline
14-35-S-100	93.04867	120127	< 3300.		UG/KG	5/25/93		Anthracene
14-35-S-100	93.04867	103333	< 3300.		UG/KG	5/25/93		Azobenzene
14-35-S-100	93.04867	92875	< 3300.		UG/KG	5/25/93		m-Benzidine
14-35-S-100	93.04867	56553	< 3300.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-S-100	93.04867	50328	< 3300.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-S-100	93.04867	205992	< 3300.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-S-100	93.04867	191242	< 3300.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-S-100	93.04867	207089	< 3300.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-S-100	93.04867	65850	< 3300.		UG/KG	5/25/93		Benzoic acid
14-35-S-100	93.04867	100516	< 3300.		UG/KG	5/25/93		Benzyl alcohol
14-35-S-100	93.04867	111911	< 3300.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-S-100	93.04867	111444	< 3300.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-S-100	93.04867	108601	< 3300.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-S-100	93.04867	117817	< 3300.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-S-100	93.04867	101553	< 3300.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-S-100	93.04867	85687	< 3300.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-S-100	93.04867	59507	< 3300.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-S-100	93.04867	106478	< 3300.		UG/KG	5/25/93		4-Chloroaniline
14-35-S-100	93.04867	91587	< 3300.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-S-100	93.04867	95578	< 3300.		UG/KG	5/25/93		o-Chlorophenol
14-35-S-100	93.04867	7005723	< 3300.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-S-100	93.04867	218019	< 3300.		UG/KG	5/25/93		Chrysene
14-35-S-100	93.04867	84742	< 3300.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-100	93.04867	117840	< 3300.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-S-100	93.04867	53703	< 3300.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-S-100	93.04867	132649	< 3300.		UG/KG	5/25/93		Dibenzofuran
14-35-S-100	93.04867	95501	< 3300.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-S-100	93.04867	541731	< 3300.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-S-100	93.04867	106467	< 3300.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-S-100	93.04867	91941	< 3300.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-S-100	93.04867	120832	< 3300.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-S-100	93.04867	84662	< 3300.		UG/KG	5/25/93		Diethyl phthalate
14-35-S-100	93.04867	131113	< 3300.		UG/KG	5/25/93		Dimethyl phthalate
14-35-S-100	93.04867	105679	< 3300.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-S-100	93.04867	51285	< 3300.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-S-100	93.04867	121142	< 3300.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-S-100	93.04867	606202	< 3300.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-S-100	93.04867	206440	< 3300.		UG/KG	5/25/93		Fluoranthene
14-35-S-100	93.04867	86737	< 3300.		UG/KG	5/25/93		Fluorene
14-35-S-100	93.04867	118741	< 3300.		UG/KG	5/25/93		Hexachlorobenzene
14-35-S-100	93.04867	87683	< 3300.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-S-100	93.04867	77474	< 3300.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-S-100	93.04867	67721	< 3300.		UG/KG	5/25/93		Hexachloroethane
14-35-S-100	93.04867	193395	< 3300.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-S-100	93.04867	78591	< 3300.		UG/KG	5/25/93		Isophorone
14-35-S-100	93.04867	534521	< 3300.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-S-100	93.04867	91576	< 3300.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-S-100	93.04867	95487	< 3300.		UG/KG	5/25/93		2-Methylphenol
14-35-S-100	93.04867	106445	< 3300.		UG/KG	5/25/93		4-Methylphenol
14-35-S-100	93.04867	91203	< 3300.		UG/KG	5/25/93		Naphthalene
14-35-S-100	93.04867	88744	< 3300.		UG/KG	5/25/93		2-Nitroaniline
14-35-S-100	93.04867	99092	< 3300.		UG/KG	5/25/93		3-Nitroaniline
14-35-S-100	93.04867	100016	< 3300.		UG/KG	5/25/93		4-Nitroaniline
14-35-S-100	93.04867	98953	< 3300.		UG/KG	5/25/93		Nitrobenzene
14-35-S-100	93.04867	88755	< 3300.		UG/KG	5/25/93		2-Nitrophenol
14-35-S-100	93.04867	100027	< 3300.		UG/KG	5/25/93		4-Nitrophenol
14-35-S-100	93.04867	621647	< 3300.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-S-100	93.04867	62759	< 3300.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-S-100	93.04867	86306	< 3300.		UG/KG	5/25/93		N-Nitrosodiphenylamine

****************** EM-9 ANALYTICAL REPORT ******************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-S-100	93.04867	87865	< 3300.		UG/KG	5/25/93		Pentachlorophenol
14-35-S-100	93.04867	85018	< 3300.		UG/KG	5/25/93		Phenanthrene
14-35-S-100	93.04867	108952	< 3300.		UG/KG	5/25/93		Phenol
14-35-S-100	93.04867	129000	< 3300.		UG/KG	5/25/93		Pyrene
14-35-S-100	93.04867	120821	< 3300.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-S-100	93.04867	95954	< 3300.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-S-100	93.04867	88062	< 3300.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04867

none

********************* EM-9 ANALYTICAL REPORT *********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04868 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-UD	93.04868	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-UD	93.04868	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-UD	93.04868	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-UD	93.04868	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-UD	93.04868	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-UD	93.04868	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-UD	93.04868	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-UD	93.04868	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-UD	93.04868	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-UD	93.04868	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-UD	93.04868	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-UD	93.04868	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-UD	93.04868	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-UD	93.04868	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-UD	93.04868	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-UD	93.04868	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-UD	93.04868	117817	540.	162.	UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-UD	93.04868	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-UD	93.04868	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-UD	93.04868	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-UD	93.04868	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-UD	93.04868	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-UD	93.04868	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-UD	93.04868	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-UD	93.04868	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-UD	93.04868	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-UD	93.04868	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-UD	93.04868	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-UD	93.04868	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-UD	93.04868	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene (1,2)
14-35-UD	93.04868	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-UD	93.04868	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-UD	93.04868	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-UD	93.04868	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-UD	93.04868	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-UD	93.04868	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-UD	93.04868	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-UD	93.04868	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-UD	93.04868	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-UD	93.04868	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-UD	93.04868	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-UD	93.04868	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-UD	93.04868	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-UD	93.04868	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-UD	93.04868	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-UD	93.04868	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-UD	93.04868	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-UD	93.04868	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-UD	93.04868	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-UD	93.04868	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-UD	93.04868	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-UD	93.04868	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-UD	93.04868	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-UD	93.04868	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-UD	93.04868	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-UD	93.04868	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-UD	93.04868	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-UD	93.04868	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-UD	93.04868	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-UD	93.04868	621647	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-UD	93.04868	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-UD	93.04868	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-UD	93.04868	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-UD	93.04868	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-UD	93.04868	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-UD	93.04868	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-UD	93.04868	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-UD	93.04868	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-UD	93.04868	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04868

none

******************** EM-9 ANALYTICAL REPORT ********************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

Customer Sample Results, Sample # 93.04869 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 5/06/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-LD	93.04869	83329	< 330.		UG/KG	5/25/93		Acenaphthene
14-35-LD	93.04869	208968	< 330.		UG/KG	5/25/93		Acenaphthylene
14-35-LD	93.04869	62533	< 330.		UG/KG	5/25/93		Aniline
14-35-LD	93.04869	120127	< 330.		UG/KG	5/25/93		Anthracene
14-35-LD	93.04869	103333	< 330.		UG/KG	5/25/93		Azobenzene
14-35-LD	93.04869	92875	< 330.		UG/KG	5/25/93		m-Benzidine
14-35-LD	93.04869	56553	< 330.		UG/KG	5/25/93		Benzo[a]anthracene
14-35-LD	93.04869	50328	< 330.		UG/KG	5/25/93		Benzo[a]pyrene
14-35-LD	93.04869	205992	< 330.		UG/KG	5/25/93		Benzo[b]fluoranthene
14-35-LD	93.04869	191242	< 330.		UG/KG	5/25/93		Benzo[g,h,i]perylene
14-35-LD	93.04869	207089	< 330.		UG/KG	5/25/93		Benzo[k]fluoranthene
14-35-LD	93.04869	65850	< 330.		UG/KG	5/25/93		Benzoic acid
14-35-LD	93.04869	100516	< 330.		UG/KG	5/25/93		Benzyl alcohol
14-35-LD	93.04869	111911	< 330.		UG/KG	5/25/93		Bis(2-chloroethoxy)methane
14-35-LD	93.04869	111444	< 330.		UG/KG	5/25/93		Bis(2-chloroethyl)ether
14-35-LD	93.04869	108601	< 330.		UG/KG	5/25/93		Bis(2-chloroisopropyl)ether
14-35-LD	93.04869	117817	< 330.		UG/KG	5/25/93		Bis(2-ethylhexyl)phthalate
14-35-LD	93.04869	101553	< 330.		UG/KG	5/25/93		4-Bromophenylphenyl ether
14-35-LD	93.04869	85687	< 330.		UG/KG	5/25/93		Butyl benzyl phthalate
14-35-LD	93.04869	59507	< 330.		UG/KG	5/25/93		4-Chloro-3-methylphenol
14-35-LD	93.04869	106478	< 330.		UG/KG	5/25/93		4-Chloroaniline
14-35-LD	93.04869	91587	< 330.		UG/KG	5/25/93		2-Chloronaphthalene
14-35-LD	93.04869	95578	< 330.		UG/KG	5/25/93		o-Chlorophenol
14-35-LD	93.04869	7005723	< 330.		UG/KG	5/25/93		4-Chlorophenylphenyl ether
14-35-LD	93.04869	218019	< 330.		UG/KG	5/25/93		Chrysene
14-35-LD	93.04869	84742	< 330.		UG/KG	5/25/93		Di-n-butyl phthalate

****************** EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-LD	93.04869	117840	< 330.		UG/KG	5/25/93		Di-n-octyl phthalate
14-35-LD	93.04869	53703	< 330.		UG/KG	5/25/93		Dibenzo[a,h]anthracene
14-35-LD	93.04869	132649	< 330.		UG/KG	5/25/93		Dibenzofuran
14-35-LD	93.04869	95501	< 330.		UG/KG	5/25/93		o-Dichlorobenzene ( )
14-35-LD	93.04869	541731	< 330.		UG/KG	5/25/93		m-Dichlorobenzene (1,3)
14-35-LD	93.04869	106467	< 330.		UG/KG	5/25/93		p-Dichlorobenzene (1,4)
14-35-LD	93.04869	91941	< 330.		UG/KG	5/25/93		3,3'-Dichlorobenzidine
14-35-LD	93.04869	120832	< 330.		UG/KG	5/25/93		2,4-Dichlorophenol
14-35-LD	93.04869	84662	< 330.		UG/KG	5/25/93		Diethyl phthalate
14-35-LD	93.04869	131113	< 330.		UG/KG	5/25/93		Dimethyl phthalate
14-35-LD	93.04869	105679	< 330.		UG/KG	5/25/93		2,4-Dimethylphenol
14-35-LD	93.04869	51285	< 330.		UG/KG	5/25/93		2,4-Dinitrophenol
14-35-LD	93.04869	121142	< 330.		UG/KG	5/25/93		2,4-Dinitrotoluene
14-35-LD	93.04869	606202	< 330.		UG/KG	5/25/93		2,6-Dinitrotoluene
14-35-LD	93.04869	206440	< 330.		UG/KG	5/25/93		Fluoranthene
14-35-LD	93.04869	86737	< 330.		UG/KG	5/25/93		Fluorene
14-35-LD	93.04869	118741	< 330.		UG/KG	5/25/93		Hexachlorobenzene
14-35-LD	93.04869	87683	< 330.		UG/KG	5/25/93		Hexachlorobutadiene
14-35-LD	93.04869	77474	< 330.		UG/KG	5/25/93		Hexachlorocyclopentadiene
14-35-LD	93.04869	67721	< 330.		UG/KG	5/25/93		Hexachloroethane
14-35-LD	93.04869	193395	< 330.		UG/KG	5/25/93		Indeno[1,2,3-cd]pyrene
14-35-LD	93.04869	78591	< 330.		UG/KG	5/25/93		Isophorone
14-35-LD	93.04869	534521	< 330.		UG/KG	5/25/93		2-Methyl-4,6-dinitrophenol
14-35-LD	93.04869	91576	< 330.		UG/KG	5/25/93		2-Methylnaphthalene
14-35-LD	93.04869	95487	< 330.		UG/KG	5/25/93		2-Methylphenol
14-35-LD	93.04869	106445	< 330.		UG/KG	5/25/93		4-Methylphenol
14-35-LD	93.04869	91203	< 330.		UG/KG	5/25/93		Naphthalene
14-35-LD	93.04869	88744	< 330.		UG/KG	5/25/93		2-Nitroaniline
14-35-LD	93.04869	99092	< 330.		UG/KG	5/25/93		3-Nitroaniline
14-35-LD	93.04869	100016	< 330.		UG/KG	5/25/93		4-Nitroaniline
14-35-LD	93.04869	98953	< 330.		UG/KG	5/25/93		Nitrobenzene
14-35-LD	93.04869	88755	< 330.		UG/KG	5/25/93		2-Nitrophenol
14-35-LD	93.04869	100027	< 330.		UG/KG	5/25/93		4-Nitrophenol
14-35-LD	93.04869	6216[4]	< 330.		UG/KG	5/25/93		N-Nitrosodi-n-propylamine
14-35-LD	93.04869	62759	< 330.		UG/KG	5/25/93		N-Nitrosodimethylamine
14-35-LD	93.04869	86306	< 330.		UG/KG	5/25/93		N-Nitrosodiphenylamine

********************* EM-9 ANALYTICAL REPORT *********************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT	COMPOUND NAME
14-35-LD	93.04869	87865	< 330.		UG/KG	5/25/93		Pentachlorophenol
14-35-LD	93.04869	85018	< 330.		UG/KG	5/25/93		Phenanthrene
14-35-LD	93.04869	108952	< 330.		UG/KG	5/25/93		Phenol
14-35-LD	93.04869	129000	< 330.		UG/KG	5/25/93		Pyrene
14-35-LD	93.04869	120821	< 330.		UG/KG	5/25/93		1,2,4-Trichlorobenzene
14-35-LD	93.04869	95954	< 330.		UG/KG	5/25/93		2,4,5-Trichlorophenol
14-35-LD	93.04869	88062	< 330.		UG/KG	5/25/93		2,4,6-Trichlorophenol

Tentatively Identified Compounds in Customer Sample # 93.04869

none

**************** EM-9 QUALITY ASSURANCE REPORT ***************

EPA SEMIVOLATILES Prepared by: BWB on 25-May-1993

REQUEST NUMBER: 14401 MATRIX: SS ANALYST: ANTHONY LOMBARDO PROGRAM CODE: M106 NOTEBOOK: R8142 PAGE: 53

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815 TECHNIQUE: GCMS ANALYTICAL PROCEDURE: EPA SW-846 3RD

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QA SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

**************** EM-9 QUALITY ASSURANCE REPORT ***************

SUMMARY OF CONTROL STATUS OF BLANK QC SAMPLES RUN WITH THIS BATCH

Blank Results, Sample # 93.04902 Date Collected: 4/01/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04902	83329	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
00.20227	93.04902	208968	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
00.20227	93.04902	62533	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
00.20227	93.04902	120127	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Anthracene
00.20227	93.04902	103333	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
00.20227	93.04902	92875	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
00.20227	93.04902	56553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
00.20227	93.04902	50328	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
00.20227	93.04902	205992	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
00.20227	93.04902	191242	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
00.20227	93.04902	207089	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
00.20227	93.04902	65850	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
00.20227	93.04902	100516	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
00.20227	93.04902	111911	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
00.20227	93.04902	111444	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
00.20227	93.04902	108601	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
00.20227	93.04902	117817	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
00.20227	93.04902	101553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
00.20227	93.04902	85687	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
00.20227	93.04902	59507	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
00.20227	93.04902	106478	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline

**************** EM-9 QUALITY ASSURANCE REPORT ***************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04902	91587	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
00.20227	93.04902	95578	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
00.20227	93.04902	7005723	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
00.20227	93.04902	218019	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Chrysene
00.20227	93.04902	84742	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
00.20227	93.04902	117840	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
00.20227	93.04902	53703	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
00.20227	93.04902	132649	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
00.20227	93.04902	95501	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
00.20227	93.04902	541731	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
00.20227	93.04902	106467	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
00.20227	93.04902	91941	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
00.20227	93.04902	120832	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
00.20227	93.04902	84662	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
00.20227	93.04902	131113	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
00.20227	93.04902	105679	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
00.20227	93.04902	51285	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
00.20227	93.04902	121142	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
00.20227	93.04902	606202	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
00.20227	93.04902	206440	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
00.20227	93.04902	86737	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
00.20227	93.04902	118741	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
00.20227	93.04902	87683	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
00.20227	93.04902	77474	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
00.20227	93.04902	67721	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
00.20227	93.04902	193395	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
00.20227	93.04902	78591	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
00.20227	93.04902	534521	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
00.20227	93.04902	91576	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
00.20227	93.04902	95487	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
00.20227	93.04902	106445	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
00.20227	93.04902	91203	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
00.20227	93.04902	88744	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
00.20227	93.04902	99092	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
00.20227	93.04902	100016	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
00.20227	93.04902	98953	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene

**************** EM-9 QUALITY ASSURANCE REPORT ***************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04902	88755	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
00.20227	93.04902	100027	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
00.20227	93.04902	621647	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
00.20227	93.04902	62759	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
00.20227	93.04902	86306	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
00.20227	93.04902	87865	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
00.20227	93.04902	85018	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
00.20227	93.04902	108952	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
00.20227	93.04902	129000	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
00.20227	93.04902	120821	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
00.20227	93.04902	95954	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
00.20227	93.04902	88062	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

Blank Results, Sample # 93.04903 Date Collected: 4/01/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/28/93

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04903	83329	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
00.20227	93.04903	208968	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
00.20227	93.04903	62533	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
00.20227	93.04903	120127	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Anthracene
00.20227	93.04903	103333	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
00.20227	93.04903	92875	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
00.20227	93.04903	56553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
00.20227	93.04903	50328	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
00.20227	93.04903	205992	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene

**************** EM-9 QUALITY ASSURANCE REPORT ***************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04903	191242	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
00.20227	93.04903	207089	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
00.20227	93.04903	65850	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
00.20227	93.04903	100516	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
00.20227	93.04903	111911	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
00.20227	93.04903	111444	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
00.20227	93.04903	108601	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
00.20227	93.04903	117817	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
00.20227	93.04903	101553	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
00.20227	93.04903	85687	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
00.20227	93.04903	59507	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
00.20227	93.04903	106478	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline
00.20227	93.04903	91587	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
00.20227	93.04903	95578	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
00.20227	93.04903	7005723	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
00.20227	93.04903	218019	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Chrysene
00.20227	93.04903	84742	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
00.20227	93.04903	117840	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
00.20227	93.04903	53703	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
00.20227	93.04903	132649	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
00.20227	93.04903	95501	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
00.20227	93.04903	541731	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
00.20227	93.04903	106467	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
00.20227	93.04903	91941	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
00.20227	93.04903	120832	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
00.20227	93.04903	84662	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
00.20227	93.04903	131113	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
00.20227	93.04903	105679	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
00.20227	93.04903	51285	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
00.20227	93.04903	121142	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
00.20227	93.04903	606202	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
00.20227	93.04903	206440	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
00.20227	93.04903	86737	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
00.20227	93.04903	118741	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
00.20227	93.04903	87683	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
00.20227	93.04903	77474	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene

********************* EM-9 QUALITY ASSURANCE REPORT ***************

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND NAME
00.20227	93.04903	67721	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
00.20227	93.04903	193395	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
00.20227	93.04903	78591	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
00.20227	93.04903	534521	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
00.20227	93.04903	91576	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
00.20227	93.04903	95487	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
00.20227	93.04903	106445	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
00.20227	93.04903	91203	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
00.20227	93.04903	88744	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
00.20227	93.04903	99092	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
00.20227	93.04903	100016	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
00.20227	93.04903	98953	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene
00.20227	93.04903	88755	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
00.20227	93.04903	100027	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
00.20227	93.04903	621647	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
00.20227	93.04903	62759	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
00.20227	93.04903	86306	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
00.20227	93.04903	87865	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
00.20227	93.04903	85018	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
00.20227	93.04903	108952	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
00.20227	93.04903	129000	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
00.20227	93.04903	120821	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
00.20227	93.04903	95954	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
00.20227	93.04903	88062	< 330.		UG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

<u>Blank Spike Results:</u> none

<u>Blank Spike Duplicate Results:</u> none

**************** EM-9 QUALITY ASSURANCE REPORT ***************

SUMMARY OF CONTROL STATUS OF BLIND QA SAMPLES RUN WITH THIS BATCH

Blind QC Results, Sample # 93.04899 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/28/93

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT	COMPOUND-NAME
93.04899	83329	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
93.04899	208968	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
93.04899	62533	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
93.04899	120127	3.8	1.14	MG/KG	4.83	0.25	5/25/93	UNDER CONTROL	Anthracene
93.04899	103333	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
93.04899	92875	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
93.04899	56553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
93.04899	50328	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
93.04899	205992	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
93.04899	191242	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
93.04899	207089	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
93.04899	65850	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
93.04899	100516	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzyl alcohol
93.04899	111911	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
93.04899	111444	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
93.04899	108601	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
93.04899	117817	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
93.04899	101553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
93.04899	85687	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
93.04899	59507	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloro-3-methylphenol
93.04899	106478	1.7	0.51	MG/KG	5.22	0.27	5/25/93	OUT OF CONTROL	4-Chloroaniline
93.04899	91587	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
93.04899	95578	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
93.04899	7005723	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
93.04899	218019	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Chrysene
93.04899	84742	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate

93.04899	117840	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
93.04899	53703	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
93.04899	132649	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
93.04899	95501	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
93.04899	541731	3.3	0.99	MG/KG	4.94	0.26	5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
93.04899	106467	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
93.04899	91941	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
93.04899	120832	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
93.04899	84662	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Diethyl phthalate
93.04899	131113	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
93.04899	105679	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
93.04899	51285	3.1	0.93	MG/KG	6.28	0.33	5/25/93	OUT OF CONTROL	2,4-Dinitrophenol
93.04899	121142	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
93.04899	606202	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
93.04899	206440	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
93.04899	86737	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
93.04899	118741	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene
93.04899	87683	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
93.04899	77474	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
93.04899	67721	4.5	1.35	MG/KG	6.37	0.33	5/25/93	UNDER CONTROL	Hexachloroethane
93.04899	193395	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
93.04899	78591	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
93.04899	534521	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
93.04899	91576	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
93.04899	95487	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylphenol
93.04899	106445	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
93.04899	91203	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
93.04899	88744	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
93.04899	99092	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
93.04899	100016	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
93.04899	98953	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene
93.04899	88755	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
93.04899	100027	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
93.04899	621647	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
93.04899	62759	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
93.04899	86306	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
93.04899	87865	4.5	1.35	MG/KG	6.02	0.31	5/25/93	UNDER CONTROL	Pentachlorophenol
93.04899	85018	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
93.04899	108952	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
93.04899	129000	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
93.04899	120821	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
93.04899	95954	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
93.04899	88062	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

Blind QC Results, Sample # 93.04900 Date Collected: 3/31/93 Date Received: 4/01/93 Date Extracted: 4/13/93 Date Analyzed: 4/29/93

93.04900	83329	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthene
93.04900	208968	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Acenaphthylene
93.04900	62533	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Aniline
93.04900	120127	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Anthracene
93.04900	103333	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Azobenzene
93.04900	92875	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	m-Benzidine
93.04900	56553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]anthracene
93.04900	50328	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[a]pyrene
93.04900	205992	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[b]fluoranthene
93.04900	191242	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[g,h,i]perylene
93.04900	207089	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzo[k]fluoranthene
93.04900	65850	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Benzoic acid
93.04900	100516	1.8	0.54	MG/KG	3.11	0.16	5/25/93	WARNING 2-3 SIG	Benzyl alcohol
93.04900	111911	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethoxy)methane
93.04900	111444	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroethyl)ether
93.04900	108601	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-chloroisopropyl)ether
93.04900	117817	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Bis(2-ethylhexyl)phthalate
93.04900	101553	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Bromophenylphenyl ether
93.04900	85687	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Butyl benzyl phthalate
93.04900	59507	2.5	0.75	MG/KG	4.51	0.23	5/25/93	WARNING 2-3 SIG	4-Chloro-3-methylphenol
93.04900	106478	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chloroaniline
93.04900	91587	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Chloronaphthalene
93.04900	95578	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Chlorophenol
93.04900	7005723	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Chlorophenylphenyl ether
93.04900	218019	2.	0.6	MG/KG	2.59	0.13	5/25/93	UNDER CONTROL	Chrysene
93.04900	84742	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-butyl phthalate
93.04900	117840	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Di-n-octyl phthalate
93.04900	53703	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzo[a,h]anthracene
93.04900	132649	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dibenzofuran
93.04900	95501	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	o-Dichlorobenzene (1,2)
93.04900	541731	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	m-Dichlorobenzene (1,3)
93.04900	106467	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	p-Dichlorobenzene (1,4)
93.04900	91941	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3,3'-Dichlorobenzidine
93.04900	120832	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dichlorophenol
93.04900	84662	1.8	0.54	MG/KG	2.8	0.15	5/25/93	UNDER CONTROL	Diethyl phthalate
93.04900	131113	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Dimethyl phthalate
93.04900	105679	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dimethylphenol
93.04900	51285	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrophenol
93.04900	121142	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4-Dinitrotoluene
93.04900	606202	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,6-Dinitrotoluene
93.04900	206440	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluoranthene
93.04900	86737	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Fluorene
93.04900	118741	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobenzene

93.04900	87683	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorobutadiene
93.04900	77474	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachlorocyclopentadiene
93.04900	67721	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Hexachloroethane
93.04900	193395	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Indeno[1,2,3-cd]pyrene
93.04900	78591	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Isophorone
93.04900	534521	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methyl-4,6-dinitrophenol
93.04900	91576	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Methylnaphthalene
93.04900	95487	2.	0.6	MG/KG	2.56	0.13	5/25/93	UNDER CONTROL	2-Methylphenol
93.04900	106445	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Methylphenol
93.04900	91203	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Naphthalene
93.04900	88744	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitroaniline
93.04900	99092	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	3-Nitroaniline
93.04900	100016	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitroaniline
93.04900	98953	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Nitrobenzene
93.04900	88755	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2-Nitrophenol
93.04900	100027	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	4-Nitrophenol
93.04900	621647	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodi-n-propylamine
93.04900	62759	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodimethylamine
93.04900	86306	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	N-Nitrosodiphenylamine
93.04900	87865	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Pentachlorophenol
93.04900	85018	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenanthrene
93.04900	108952	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Phenol
93.04900	129000	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	Pyrene
93.04900	120821	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	1,2,4-Trichlorobenzene
93.04900	95954	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,5-Trichlorophenol
93.04900	88062	< 0.33		MG/KG	0.0		5/25/93	UNDER CONTROL	2,4,6-Trichlorophenol

**************** EM-9 QUALITY ASSURANCE REPORT ***************

SURROGATE RESULTS FOR EPA SEMIVOLATILES

Surrogate 1 = 2-Fluorophenol (CAS # = 367124)
Surrogate 2 = Phenol-d5 (CAS # = 4165622)
Surrogate 3 = Nitrobenzene-d5 (CAS # = 4165600)
Surrogate 4 = 2-Fluorobiphenyl (CAS # = 321608)
Surrogate 5 = 2,4,6-Tribromophenol (CAS # = 118796)
Surrogate 6 = p-Terphenyl-d14 (CAS # =)

SAMPLE NUMBER	UNITS	Surrogate 1	Surrogate 2	Surrogate 3	Surrogate 4	Surrogate 5	Surrogate 6	COMPLETION DATE
93.04845	%	54.43	73.87	66.76	76.08	94.2	86.16	25-May-1993
93.04845	%	40.67	62.6	54.6	67.48	86.23	85.18	25-May-1993
93.04845	%	30.47	48.47	46.14	65.98	81.55	77.94	25-May-1993
93.04846	%	38.15	57.7	51.58	68.4	87.68	85.78	25-May-1993
93.04847	%	38.63	61.28	51.96	74.72	91.29	95.6	25-May-1993
93.04848	%	31.3	53.95	45.9	62.96	89.39	102.2	25-May-1993
93.04849	%	42.96	69.21	60.7	95.1	108.22	123.14	25-May-1993
93.04850	%	[illegible].49	47.9	42.52	59.96	92.37	100.14	25-May-1993
93.04851	%	37.62	57.41	53.94	68.98	75.97	88.76	25-May-1993
93.04852	%	41.95	65.93	58.1	72.66	92.71	98.28	25-May-1993
93.04853	%	39.73	55.07	53.66	66.18	77.54	90.24	25-May-1993
93.04854	%	40.52	63.29	53.38	71.06	90.23	93.84	25-May-1993
93.04855	%	36.28	65.14	51.8	79.78	110.28	108.3	25-May-1993
93.04856	%	41.4	60.98	52.8	66.18	94.77	87.32	25-May-1993
93.04857	%	54.28	75.27	70.84	90.7	114.69	114.78	25-May-1993
93.04858	%	51.88	77.64	63.64	81.44	100.51	84.92	25-May-1993
93.04859	%	60.1	81.5	74.2	82.8	102.4	93.4	25-May-1993
93.04860	%	57.5	78.14	67.82	82.48	105.67	109.44	25-May-1993
93.04861	%	35.51	50.95	44.26	56.5	92.66	88.18	25-May-1993
93.04862	%	55.61	79.57	68.32	80.28	89.92	103.56	25-May-1993
93.04863	%	45.87	64.63	60.76	85.8	123.6	121.68	25-May-1993
93.04864	%	67.43	84.22	82.46	88.5	101.4	127.16	25-May-1993
93.04865	%	72.8	90.	79.2	87.8	82.5	113.4	25-May-1993
93.04865	%	73.2	92.9	77.6	92.	90.2	116.4	25-May-1993
93.04865	%	72.4	85.6	84.4	84.4	80.9	114.4	25-May-1993
93.04866	%	42.56	58.64	53.72	65.02	94.29	95.02	25-May-1993

**************** EM-9 QUALITY ASSURANCE REPORT ***************

SAMPLE NUMBER	UNITS	Surrogate 1	Surrogate 2	Surrogate 3	Surrogate 4	Surrogate 5	Surrogate 6	COMPLETION DATE
93.04867	%	78.5	87.6	74.6	90.4	97.1	117.8	25-May-1993
93.04868	%	66.6	86.	74.28	85.34	108.82	94.68	25-May-1993
93.04869	%	83.24	98.92	89.58	90.58	115.21	116.72	25-May-1993
93.04899	%	63.01	72.8	75.38	74.	88.51	87.78	25-May-1993
93.04900	%	55.67	66.71	63.64	68.6	85.37	78.2	25-May-1993
93.04902	%	18.12	28.73	36.2	47.92	70.98	94.74	25-May-1993
93.04903	%	19.21	24.	26.02	34.66	63.85	88.96	25-May-1993
EPA Limits:								
Water	%	21 - 100	10 - 94	35 - 114	43 - 116	10 - 123	33 - 141	
Soil	%	25 - 121	24 - 113	23 - 120	30 - 115	19 - 122	18 - 137	

REPORT NUMBER: 18666

Bridgid Berg	Anthony Bondardo		mag
Analyst	Reviewer	Section Leader	QA Officer
5/26/93	5/26/93	5/26/93	5-26-93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

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Metals Analyses

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: Philip Fresquez, EM-8

DATE: September 15, 1993

FROM: Cynthia Mahan, EM-9

MAIL STOP/TELEPHONE: E518/7-6011

SUBJECT: Results Associated with Request 14399.

I apologize for the delay in reporting the analytical data for request 14399. The delay was due in part because Hg results were missing on three of the samples, numbers 93.04868-70. Unfortunately, these soil extracts were consumed during the metals analysis and Hg information could not be obtained. We regret this inconvenience, but if it is possible for you to resample, we would certainly analyze the samples for you at our cost. The blind qc results for all elements except Ag were "under control". However the Ag run-time qc's were all statistically acceptable. Ag is likely precipitating from the qc samples. If you have any questions, please give me a call.

REPORT NUMBER: 20562

TCLP-091 Ba, Cd, Cr, Pb

2 samples TA-14-35-0-0 TA-14-35-S-10 exceed TCLP Pb 75 ppm

*********** EM-9 ANALYTICAL REPORT ***********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 233

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	ppm UNITS	COMPLETION DATE	COMMENT	
14-35-0-0	93.04845	AG	ICPES	< 0.01		MG/L	7/23/93	07061H	<5 ppm
14-35-0-0	93.04845	BA	ICPES	2.5	0.3	MG/L	7/23/93	07061H	<100 ppm
14-35-0-0	93.04845	CD	ICPES	< 0.003		MG/L	7/23/93	07061H	<1 ppm >E
14-35-0-0	93.04845	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	<1 ppm
14-35-0-0	93.04845	PB	ICPES	56.	6.	MG/L	7/23/93	07061H	75 ppm
14-35-E-5	93.04846	AG	ICPES	0.02	0.007	MG/L	7/23/93	07061H	
14-35-E-5	93.04846	BA	ICPES	1.4	0.1	MG/L	7/23/93	07061H	
14-35-E-5	93.04846	CD	ICPES	0.004	0.002	MG/L	7/23/93	07061H	ok
14-35-E-5	93.04846	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-5	93.04846	PB	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-E-10	93.04847	AG	ICPES	0.016	0.008	MG/L	7/23/93	07061H	
14-35-E-10	93.04847	BA	ICPES	1.1	0.1	MG/L	7/23/93	07061H	ok
14-35-E-10	93.04847	CD	ICPES	0.003	0.0004	MG/L	7/23/93	07061H	
14-35-E-10	93.04847	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-10	93.04847	PB	ICPES	0.32	0.04	MG/L	7/23/93	07061H	
14-35-E-25	93.04848	AG	ICPES	< 0.01		MG/L	7/23/93	07061H	
14-35-E-25	93.04848	BA	ICPES	0.94	0.01	MG/L	7/23/93	07061H	ok
14-35-E-25	93.04848	CD	ICPES	0.004	0.001	MG/L	7/23/93	07061H	
14-35-E-25	93.04848	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-25	93.04848	PB	ICPES	0.36	0.04	MG/L	7/23/93	07061H	
14-35-E-50	93.04849	AG	ICPES	0.011	0.003	MG/L	7/23/93	07061H	
14-35-E-50	93.04849	BA	ICPES	1.1	0.1	MG/L	7/23/93	07061H	ok
14-35-E-50	93.04849	CD	ICPES	0.004	0.002	MG/L	7/23/93	07061H	
14-35-E-50	93.04849	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-50	93.04849	PB	ICPES	1.1	0.1	MG/L	7/23/93	07061H	
14-35-E-100	93.04850	AG	ICPES	0.02	0.01	MG/L	7/23/93	07061H	
14-35-E-100	93.04850	BA	ICPES	1.	0.1	MG/L	7/23/93	07061H	ok
14-35-E-100	93.04850	CD	ICPES	0.003	0.003	MG/L	7/23/93	07061H	
14-35-E-100	93.04850	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-100	93.04850	PB	ICPES	0.05	0.03	MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	AG	ICPES	< 0.01		MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	BA	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	CD	ICPES	0.007	0.003	MG/L	7/23/93	07061H	ok
14-35-E-10R	93.04851	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-E-10R	93.04851	PB	ICPES	0.66	0.06	MG/L	7/23/93	07061H	
14-35-SE-5	93.04852	AG	ICPES	0.022	0.008	MG/L	7/23/93	07061H	
14-35-SE-5	93.04852	BA	ICPES	1.4	0.1	MG/L	7/23/93	07061H	

Pb

Rep

14-35-SE-5	93.04852	CD	ICPES	0.005	0.0008	MG/L	7/23/93	07061H	
14-35-SE-5	93.04852	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-5	93.04852	PB	ICPES	1.1	0.1	MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	AG	ICPES	0.014	0.006	MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	BA	ICPES	1.6	0.2	MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	CD	ICPES	0.006	0.002	MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-10	93.04853	PB	ICPES	3.3	0.3	MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	AG	ICPES	0.025	0.005	MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	BA	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	CD	ICPES	< 0.003		MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-25	93.04854	PB	ICPES	0.73	0.07	MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	AG	ICPES	0.03	0.004	MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	BA	ICPES	0.91	0.09	MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	CD	ICPES	< 0.003		MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-50	93.04855	PB	ICPES	< 0.03		MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	AG	ICPES	0.024	0.008	MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	BA	ICPES	0.61	0.06	MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	CD	ICPES	0.003	0.0007	MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SE-100	93.04856	PB	ICPES	< 0.03		MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	AG	ICPES	0.024	0.002	MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	BA	ICPES	1.2	0.1	MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	CD	ICPES	0.005	0.0007	MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	CR	ICPES	0.004	0.002	MG/L	7/23/93	07061H	
14-35-SW-5	93.04857	PB	ICPES	1.5	0.2	MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	AG	ICPES	0.018	0.002	MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	BA	ICPES	1.1	0.1	MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	CD	ICPES	0.005	0.001	MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	CR	ICPES	< 0.004		MG/L	7/23/93	07061H	
14-35-SW-10	93.04858	PB	ICPES	1.3	0.1	MG/L	7/23/93	07061H	
14-35-SW-25	93.04859	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-25	93.04859	BA	ICPES	1.	0.1	MG/L	8/09/93	07021H	
14-35-SW-25	93.04859	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-25	93.04859	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-25	93.04859	PB	ICPES	0.76	0.08	MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	BA	ICPES	0.72	0.07	MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-50	93.04860	PB	ICPES	< 0.04		MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	AG	ICPES	0.01	0.01	MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	BA	ICPES	0.41	0.04	MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-SW-100	93.04861	PB	ICPES	0.05	0.01	MG/L	8/09/93	07021H	
14-35-S-5	93.04862	AG	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-5	93.04862	BA	ICPES	1.5	0.2	MG/L	8/09/93	07021H	
14-35-S-5	93.04862	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-5	93.04862	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-5	93.04862	PB	ICPES	1.8	0.2	MG/L	8/09/93	07021H	
14-35-S-10	93.04863	AG	ICPES	0.01	0.01	MG/L	8/09/93	07021H	
14-35-S-10	93.04863	BA	ICPES	0.78	0.08	MG/L	8/09/93	07021H	
14-35-S-10	93.04863	CD	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-10	93.04863	CR	ICPES	< 0.01		MG/L	8/09/93	07021H	
14-35-S-10	93.04863	PB	ICPES	4.6	0.5	MG/L	8/09/93	07021H	>5ppm
14-35-S-25	93.04864	AG	ICPES	0.02	0.01	MG/L	8/09/93	07021H	
14-35-S-25	93.04864	BA	ICPES	0.89	0.09	MG/L	8/09/93	07021H	

14-35-S-25	93.04864	CD	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-25	93.04864	CR	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-25	93.04864	PB	ICPES	< 0.04		MG/L	8/09/93	07021H
14-35-S-50	93.04865	AG	ICPES	0.02	0.01	MG/L	8/09/93	07021H
14-35-S-50	93.04865	BA	ICPES	1.2	0.1	MG/L	8/09/93	07021H
14-35-S-50	93.04865	CD	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-50	93.04865	CR	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-50	93.04865	PB	ICPES	0.43	0.04	MG/L	8/09/93	07021H
14-35-S-10R	93.04866	AG	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-10R	93.04866	BA	ICPES	0.85	0.09	MG/L	8/09/93	07021H
14-35-S-10R	93.04866	CD	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-10R	93.04866	CR	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-10R	93.04866	PB	ICPES	0.3	0.03	MG/L	8/09/93	07021H
14-35-S-100	93.04867	AG	ICPES	0.01	0.01	MG/L	8/09/93	07021H
14-35-S-100	93.04867	BA	ICPES	0.64	0.06	MG/L	8/09/93	07021H
14-35-S-100	93.04867	CD	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-100	93.04867	CR	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-S-100	93.04867	PB	ICPES	< 0.04		MG/L	8/09/93	07021H
14-35-UD	93.04868	AG	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-UD	93.04868	BA	ICPES	1.6	0.2	MG/L	8/09/93	07021H
14-35-UD	93.04868	CD	ICPES	0.04	0.01	MG/L	8/09/93	07021H
14-35-UD	93.04868	CR	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-UD	93.04868	PB	ICPES	0.06	0.01	MG/L	8/09/93	07021H
14-35-LD	93.04869	AG	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-LD	93.04869	BA	ICPES	1.1	0.1	MG/L	8/09/93	07021H
14-35-LD	93.04869	CD	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-LD	93.04869	CR	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-LD	93.04869	PB	ICPES	< 0.04		MG/L	8/09/93	07021H
14-35-RIN	93.04870	AG	ICPES	< 0.01		MG/L	8/09/93	07021H
14-35-RIN	93.04870	BA	ICPES	0.38	0.04	MG/L	8/09/93	07021H
14-35-RIN	93.04870	CD	ICPES	< 0.003		MG/L	8/09/93	07021H
14-35-RIN	93.04870	CR	ICPES	0.027	0.003	MG/L	8/09/93	07021H
14-35-RIN	93.04870	PB	ICPES	0.12	0.01	MG/L	8/09/93	07021H

REPORT NUMBER: 20562 (continued)

*********** EM-9 QUALITY ASSURANCE REPORT **********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 233

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00895	AG	< 10.		UG/L	9.8	0.8	8/10/93	UNDER CONTROL
00.00895	BA	100.	10.	UG/L	44.	2.	8/10/93	OUT OF CONTROL
00.00895	CD	19.	2.	UG/L	20.	1.	8/10/93	UNDER CONTROL
)0.00895	CR	15.	2.	UG/L	18.6	0.4	8/10/93	UNDER CONTROL
00.00895	PB	40.	10.	UG/L	23.7	0.7	8/10/93	UNDER CONTROL
00.28333	AG	2.3	0.2	MG/L	2.	0.09	7/23/93	UNDER CONTROL
00.28333	AG	2.	0.2	MG/L	2.	0.09	8/10/93	UNDER CONTROL
00.28333	BA	11.	1.	MG/L	10.	0.43	8/10/93	UNDER CONTROL
00.28333	BA	11.	1.	MG/L	10.	0.43	7/23/93	UNDER CONTROL
00.28333	CD	11.	1.	MG/L	9.96	0.43	7/23/93	UNDER CONTROL
00.28333	CD	10.	1.	MG/L	9.96	0.43	8/10/93	UNDER CONTROL
00.28333	CR	11.	1.	MG/L	9.97	0.43	7/23/93	UNDER CONTROL
00.28333	CR	9.7	0.9	MG/L	9.97	0.43	8/10/93	UNDER CONTROL
00.28333	PB	11.	1.	MG/L	10.1	0.43	7/23/93	UNDER CONTROL
00.28333	PB	11.	1.	MG/L	10.1	0.43	8/10/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04918	AG	190.	20.	UG/L	3059.	132.	8/09/93	OUT OF CONTROL
93.04918	BA	1800.	200.	UG/L	1793.	77.	8/09/93	UNDER CONTROL
93.04918	CD	2100.	200.	UG/L	2211.	95.	8/09/93	UNDER CONTROL
93.04918	CR	< 4.		UG/L	0.0		8/09/93	UNDER CONTROL
'.04918	PB	23000.	2000.	UG/L	22697.	976.	8/09/93	UNDER CONTROL
.04919	AG	220.	20.	UG/L	311.	13.	8/09/93	OUT OF CONTROL
93.04919	BA	5100.	500.	UG/L	4955.	213.	8/09/93	UNDER CONTROL
93.04919	CD	3000.	300.	UG/L	2988.	128.	8/09/93	UNDER CONTROL
93.04919	CR	290.	30.	UG/L	311.	13.	8/09/93	UNDER CONTROL

93.04919 PB	31000.	3000.	UG/L	29339.	1262.	8/09/93	UNDER CONTROL
93.04920 AG	190.	20.	UG/L	4012.	173.	8/09/93	OUT OF CONTROL
93.04920 BA	1400.	100.	UG/L	1394.	60.	8/09/93	UNDER CONTROL
.04920 CD	< 3.		UG/L	0.0		8/09/93	UNDER CONTROL
.04920 CR	2800.	300.	UG/L	3104.	133.	8/09/93	UNDER CONTROL
93.04920 PB	17000.	2000.	UG/L	16758.	721.	8/09/93	UNDER CONTROL

REPORT NUMBER: 20562

H.P.	DfGerth	CAm	mag
Analyst	Reviewer	Section Leader	QA Officer
9/15/93	9/15/93	9/15/93	9/17/93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

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REPORT NUMBER: 20563

TCLP - (As, Hg, Se (all ok)).

*********** EM-9 ANALYTICAL REPORT ***********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: HARRY PATTERSON PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: Y004330 PAGE: 130

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	ppb UNITS	COMPLETION DATE	COMMENT
14-35-0-0	93.04845	AS	ETVAA	< 2.		UG/L	6/18/93	<5 ppm
14-35-0-0	93.04845	HG	CVAA	< 0.2		UG/L	6/25/93	<2 ppm ok
14-35-0-0	93.04845	SE	ETVAA	< 2.		UG/L	6/18/93	<1 ppm
14-35-E-5	93.04846	AS	ETVAA	2.79	2.	UG/L	6/18/93	
14-35-E-5	93.04846	HG	CVAA	< 0.2		UG/L	6/25/93	ok
14-35-E-5	93.04846	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-10	93.04847	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-10	93.04847	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-E-10	93.04847	SE	ETVAA	< 2.		UG/L	6/23/93	ok
14-35-E-25	93.04848	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-25	93.04848	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-E-25	93.04848	SE	ETVAA	< 2.		UG/L	6/18/93	ok
14-35-E-50	93.04849	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-50	93.04849	HG	CVAA	0.2		UG/L	6/25/93	
14-35-E-50	93.04849	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-100	93.04850	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-100	93.04850	HG	CVAA	< 0.2		UG/L	6/25/93	ok
14-35-E-100	93.04850	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-10R	93.04851	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-E-10R	93.04851	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-E-10R	93.04851	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-5	93.04852	AS	ETVAA	2.86	2.	UG/L	6/18/93	
14-35-SE-5	93.04852	HG	CVAA	< 0.2		UG/L	6/25/93	ok
14-35-SE-5	93.04852	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-10	93.04853	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-10	93.04853	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-10	93.04853	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-25	93.04854	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-25	93.04854	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-25	93.04854	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-50	93.04855	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-50	93.04855	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-50	93.04855	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-100	93.04856	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SE-100	93.04856	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SE-100	93.04856	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-5	93.04857	AS	ETVAA	2.5	2.	UG/L	7/08/93	

14-35-SW-5	93.04857	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-5	93.04857	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-10	93.04858	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-10	93.04858	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-10	93.04858	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-25	93.04859	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-25	93.04859	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-25	93.04859	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-50	93.04860	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-50	93.04860	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-50	93.04860	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-SW-100	93.04861	AS	ETVAA	3.1	2.	UG/L	7/08/93	
14-35-SW-100	93.04861	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-100	93.04861	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-5	93.04862	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-5	93.04862	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-5	93.04862	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-10	93.04863	AS	ETVAA	2.7	2.	UG/L	7/08/93	
14-35-S-10	93.04863	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-10	93.04863	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-25	93.04864	AS	ETVAA	2.7	2.	UG/L	7/08/93	
14-35-S-25	93.04864	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-25	93.04864	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-50	93.04865	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-50	93.04865	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-50	93.04865	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-10R	93.04866	AS	ETVAA	2.9	2.	UG/L	7/08/93	
14-35-S-10R	93.04866	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-10R	93.04866	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-100	93.04867	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-100	93.04867	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-100	93.04867	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-UD	93.04868	AS	ETVAA	3.	2.	UG/L	7/08/93	
14-35-UD	93.04868	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-LD	93.04869	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-LD	93.04869	SE	ETVAA	< 2.		UG/L	7/08/93	
14-35-RIN	93.04870	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-RIN	93.04870	SE	ETVAA	< 2.		UG/L	7/08/93	

CUSTOMER SAMPLE DUPLICATES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-SE-10	93.04853	AS	ETVAA	< 2.		UG/L	6/18/93	
14-35-SE-10	93.04853	SE	ETVAA	< 2.		UG/L	6/18/93	
14-35-SW-5	93.04857	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-SW-5	93.04857	HG	CVAA	< 0.2		UG/L	6/25/93	
14-35-S-100	93.04867	AS	ETVAA	< 2.		UG/L	7/08/93	
14-35-S-100	93.04867	SE	ETVAA	< 2.		UG/L	7/08/93	

MATRIX SPIKES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT
14-35-SE-10	93.04853	AS	ETVAA	10.	13.	UG/L	6/18/93	
14-35-SE-10	93.04853	SE	ETVAA	10.	8.96	UG/L	6/18/93	

14-35-S-100	93.04867 AS	ETVAA	1.	1.	UG/L	7/08/93
14-35-S-100	93.04867 SE	ETVAA	1.	1.4	UG/L	7/08/93

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REPORT NUMBER: 20563 (continued)

*********** EM-9 QUALITY ASSURANCE REPORT **********

Prepared by: CMAHAN on 15-Sep-1993

REQUEST NUMBER: 14399 MATRIX: SE ANALYST: HARRY PATTERSON PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: Y004330 PAGE: 130

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00895	AS	55.7	11.1	UG/L	49.		7/08/93	UNDER CONTROL
00.00895	SE	8.5	1.7	UG/L	9.7	0.5	7/08/93	UNDER CONTROL
00.23653	HG	4.	0.4	UG/L	4.	0.2	6/25/93	UNDER CONTROL
)0.26379	AS	75.37	15.7	UG/L	70.	3.	6/18/93	UNDER CONTROL
00.26379	AS	75.3	15.	UG/L	70.	3.	7/08/93	UNDER CONTROL
00.26379	SE	49.8	9.8	UG/L	50.	2.	7/08/93	UNDER CONTROL
00.26379	SE	44.26	8.8	UG/L	50.	2.	6/18/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04912	HG	1.1	0.2	UG/L	1.	0.06	6/25/93	UNDER CONTROL
93.04913	HG	3.9	0.4	UG/L	4.	0.24	6/25/93	UNDER CONTROL
93.04914	HG	4.	0.4	UG/L	4.	0.24	6/25/93	UNDER CONTROL
93.04915	AS	26.5	5.3	UG/L	26.	1.2	7/08/93	UNDER CONTROL
93.04915	SE	10.4	2.1	UG/L	10.	0.4	7/08/93	UNDER CONTROL
93.04916	AS	28.3	5.6	UG/L	30.	1.3	7/08/93	UNDER CONTROL
93.04916	SE	64.8	13.	UG/L	65.	2.8	7/08/93	UNDER CONTROL
93.04917	AS	36.	7.2	UG/L	37.5	1.6	7/08/93	UNDER CONTROL
93.04917	SE	< 2.		UG/L	0.0		7/08/93	UNDER CONTROL

ˇPORT NUMBER: 20563

H.P.	DJGerth	GAm	mag
Analyst	Reviewer	Section Leader	QA Officer
9/15/93	9/15/93	9/15/93	9/16/93

Date	Date	Date	Date

Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

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Total Be and Pb

REPORT NUMBER: 18315

********** EM-9 ANALYTICAL REPORT ***********

Prepared by: JDMORGAN on 28-Apr-1993

REQUEST NUMBER: 14400 MATRIX: SS ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: ICPES ANALYTICAL PROCEDURE: NOTEBOOK: R8149 PAGE: 111

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	ppm UNITS	COMPLETION DATE	COMMENT
14-35-0-0	93.04871	BE	0.15	0.03	UG/G	4/27/93	DB0416H
14-35-0-0	93.04871	PB	410.	41.	UG/G	4/27/93	DB0416H
14-35-E-5	93.04872	BE	1.7	0.4	UG/G	4/27/93	DB0416H
14-35-E-5	93.04872	PB	85.	8.	UG/G	4/27/93	DB0416H
14-35-E-10	93.04873	BE	0.28	0.06	UG/G	4/27/93	DB0416H
14-35-E-10	93.04873	PB	49.	5.	UG/G	4/27/93	DB0416H
14-35-E-25	93.04874	BE	0.37	0.07	UG/G	4/27/93	DB0416H
14-35-E-25	93.04874	PB	225.	23.	UG/G	4/27/93	DB0416H
14-35-E-50	93.04875	BE	0.22	0.04	UG/G	4/27/93	DB0416H
14-35-E-50	93.04875	PB	97.	9.	UG/G	4/27/93	DB0416H
14-35-E-100	93.04876	BE	0.5	0.1	UG/G	4/27/93	DB0416H
14-35-E-100	93.04876	PB	75.	7.	UG/G	4/27/93	DB0416H
14-35-E-10R	93.04877	BE	0.38	0.07	UG/G	4/27/93	DB0416H
14-35-E-10R	93.04877	PB	40.	5.	UG/G	4/27/93	DB0416H
14-35-SE-5	93.04878	BE	0.38	0.07	UG/G	4/27/93	DB0416H
14-35-SE-5	93.04878	PB	45.	5.	UG/G	4/27/93	DB0416H
14-35-SE-10	93.04879	BE	0.36	0.07	UG/G	4/27/93	DB0416H
14-35-SE-10	93.04879	PB	150.	15.	UG/G	4/27/93	DB0416H
14-35-SE-25	93.04880	BE	0.33	0.06	UG/G	4/27/93	DB0416H
14-35-SE-25	93.04880	PB	39.	5.	UG/G	4/27/93	DB0416H
14-35-SE-50	93.04881	BE	0.6	0.1	UG/G	4/27/93	DB0416H
14-35-SE-50	93.04881	PB	< 15.		UG/G	4/27/93	DB0416H
14-35-SE-100	93.04882	BE	0.36	0.08	UG/G	4/27/93	DB0416H
14-35-SE-100	93.04882	PB	< 15.		UG/G	4/27/93	DB0416H
14-35-SW-5	93.04883	BE	0.2	0.1	UG/G	4/27/93	DB0416H
14-35-SW-5	93.04883	PB	73.	7.	UG/G	4/27/93	DB0416H
14-35-SW-10	93.04884	BE	0.33	0.06	UG/G	4/27/93	DB0416H
14-35-SW-10	93.04884	PB	64.	6.	UG/G	4/27/93	DB0416H
14-35-SW-25	93.04885	BE	0.36	0.07	UG/G	4/27/93	DB0416H
14-35-SW-25	93.04885	PB	60.	6.	UG/G	4/27/93	DB0416H
14-35-SW-50	93.04886	BE	1.1	0.2	UG/G	4/27/93	DB0416H
14-35-SW-50	93.04886	PB	31.	3.	UG/G	4/27/93	DB0416H
14-35-SW-100	93.04887	BE	1.4	0.2	UG/G	4/27/93	DB0416H
14-35-SW-100	93.04887	PB	70.	7.	UG/G	4/27/93	DB0416H
14-35-S-5	93.04888	BE	0.5	0.1	UG/G	4/27/93	DB0416H
14-35-S-5	93.04888	PB	125.	13.	UG/G	4/27/93	DB0416H
14-35-S-10	93.04889	BE	0.13	0.02	UG/G	4/27/93	DB0416BH

Be = 2.88 U.L.
Pb = 54 ppm U.L.

Be
0.23 to ~~0.50~~ 1.70
0.58 (± 0.60) ppm

Pb
40 to 225 ppm
95 (± 67) ppm

Be
0.33 to 0.6
0.40 (± 0.11)

Pb
<15 to 150 ppm
53 (± 56) ppm

Be
0.2 to 1.4
0.67 (± 0.53)

Pb
31 to 73 ppm
60 (± 17)

14-35-S-10	93.04889	PB	45.	5.	UG/G	4/27/93	DB0416BH	Be
14-35-S-25	93.04890	BE	0.9	0.2	UG/G	4/27/93	DB0416BH	0.13 to 0.9
14-35-S-25	93.04890	PB	19.	2.	UG/G	4/27/93	DB0416BH	0.47 (± 0.3
14-35-S-50	93.04891	BE	0.41	0.08	UG/G	4/27/93	DB0416BH	
14-35-S-50	93.04891	PB	43.	4.	UG/G	4/27/93	DB0416BH	Pb
14-35-S-10R	93.04892	BE	0.22	0.04	UG/G	4/27/93	DB0416BH	
14-35-S-10R	93.04892	PB	< 15.		UG/G	4/27/93	DB0416BH	<15 to 125 pp
14-35-S-100	93.04893	BE	0.7	0.1	UG/G	4/27/93	DB0416BH	48 (± 40) ppm
14-35-S-100	93.04893	PB	41.	4.	UG/G	4/27/93	DB0416BH	
14-35-UD	93.04894	BE	0.9	0.2	UG/G	4/27/93	DB0416BH	.3e
14-35-UD	93.04894	PB	75.	8.	UG/G	4/27/93	DB0416BH	
14-35-LD	93.04895	BE	1.1	0.2	UG/G	4/27/93	DB0416BH	
14-35-LD	93.04895	PB	35.	4.	UG/G	4/27/93	DB0416BH	

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REPORT NUMBER: 18315 (continued)

*********** EM-9 QUALITY ASSURANCE REPORT **********

Prepared by: JDMORGAN on 28-Apr-1993

REQUEST NUMBER: 14400 MATRIX: SS ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: R8149 PAGE: 111

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.27503	BE	2.5	0.3	MG/L	2.5	0.1	4/27/93	UNDER CONTROL
00.27503	PB	10.	1.	MG/L	10.	0.4	4/27/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04897	BE	0.3	0.1	MG/L	0.25	0.01	4/27/93	UNDER CONTROL
93.04897	PB	2.4	0.2	MG/L	2.06	0.09	4/27/93	UNDER CONTROL
93.04898	BE	1.2	0.1	MG/L	1.15	0.05	4/27/93	UNDER CONTROL
93.04898	PB	17.	2.	MG/L	16.8	0.7	4/27/93	UNDER CONTROL
93.04904	BE	0.27	0.05	MG/L	0.25	0.01	4/27/93	UNDER CONTROL
93.04904	PB	2.1	0.2	MG/L	2.06	0.09	4/27/93	UNDER CONTROL

REPORT NUMBER: 18315

JDMorgan	BDuran	[illegible]	mag
Analyst	Reviewer	Section Leader	QA Officer
4/29/93	4/28/93	4/29/93	4/29/93
Date	Date	Date	Date

` Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

REPORT NUMBER: 18384

Total Be and Pb in water -

*********** EM-9 ANALYTICAL REPORT ************

Prepared by: JDMORGAN on 5-May-1993

REQUEST NUMBER: 14400 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: ICPES ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	(ppb) UNITS	COMPLETION DATE	COMMENT
14-35-RIN	93.04896	BE	1.3	0.1	UG/L	5/03/93	
14-35-RIN	93.04896	PB	98.	40.	UG/L	5/03/93	

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REPORT NUMBER: 18384 (continued)

*********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: JDMORGAN on 5-May-1993

REQUEST NUMBER: 14400 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

NOTEBOOK: PAGE:

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.27503	BE	2.5	0.3	MG/L	2.5	0.1	5/03/93	UNDER CONTROL
00.27503	PB	11.	1.	MG/L	10.	0.4	5/03/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

___ Only qualitative data requested

_✓_ Only Open (non-blind) QC samples run with this sample batch.

___ No QC samples run with this sample batch.

___ No QC samples for this constituent and matrix type available within EM-9

REPORT NUMBER: 18384

JD Morgan	B Duran	CMA	Laura Kelly for mag
Analyst	Reviewer	Section Leader	QA Officer
5/5/93	5/5/93	5/5/93	5/6/93
Date	Date	Date	Date

Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in

'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

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HE Analyses

Los Alamos
NATIONAL LABORATORY
memorandum
EXPLOSIVES TECHNOLOGY
M-1

To/MS: Phil Fresquez, EM-8, K490
Thru: T. Spontarelli, M-1, MS C920
From/MS: Wayne King, M-1, MS C920
Phone/FAX: (505)667-6751/(505)667-0500
Symbol: M-1:92-169
Date: July 1, 1993

SUBJECT: SOIL SAMPLES (U)

Seventy-four soil samples and three water samples were received from EM-8 for explosive residue analysis. The predominant explosives of interest were HMX, RDX, Tetryl, TNT, and 2,4-DNT.

Three quality control samples were analyzed, along with the 77 environmental samples, to verify the method. The average per cent recovery data is given in Table 1.

The detection limits (as shown in Table 2) were established by preparing a series of calibration standards with the concentration of analyses in solution that can be detected with a 95% certainty.

WK/pdg

Cy: D. B. Griechen, M-DO, MS P915
T. Spontarelli, M-1
W. King, M-1
M-1 File

TABLE 1

Recovery data from quality control samples

EXPLOSIVE	RESULT	UNITS	QC VALUE	% RECOVERY
HMX	1.2	ug/g	0.9	125
RDX	1.1	ug/g	1.0	107
TETRYL	0.9	ug/g	1.0	90
TNT	1.0	ug/g	1.0	100
2,4 DNT	1.1	ug/g	1.0	109
HMX	11.2	ug/g	10.0	111
RDX	10.2	ug/g	10.0	102
TETRYL	15.3	ug/g	10.0	135
TNT	13.2	ug/g	10.0	124
2,4 DNT	10.9	ug/g	10.0	108
HMX	113.8	ug/g	100.3	112
RDX	99.5	ug/g	100.1	99
TETRYL	170.1	ug/g	100.0	141
TNT	143.6	ug/g	100.0	130
2,4 DNT	109.7	ug/g	100.1	109

TABLE 2

COMPOUND	ug/g
HMX	<0.3
RDX	<0.3
TETRYL	<0.4
TNT	<0.4
2,4 DNT	<0.2

HMX RDX Tetryl and TNT (Not ND 2,4,DNT).

GROUP M-1 ANALYTICAL LABORATORY REPORT

Requestor	Phil Fresquez	**Lab. No.**	21764
Sample	[redacted]ples from TA-14-35	**P.O./P.C**	M-106
Analysis Req'd	HE Detection	**Date Rec'd**	4/14/93
Operator	Wayne King	**Reported**	6/28/93

SAMPLE	HMX µg/g	RDX µg/g	TETRYL µg/g	TNT µg/g	2,4 DNT µg/g
TA-14-35-0-0	198.7	<0.3	12.7	181.6	<0.2
TA-14-35-E-5	391.4	<0.3	1.1	27.5	<0.2
TA-14-35-E-10	200.5	<0.3	<0.4	0.7	<0.2
TA-14-35-E-25	210.5	<0.3	<0.4	<0.4	<0.2
TA-14-35-E-50	270.8	<0.3	<0.4	<0.4	<0.2
TA-14-35-E-100	110.4	1.9	<0.4	<0.4	<0.2
TA-14-35-E-10R	141.2	<0.3	<0.4	2.1	<0.2
TA-14-35-SE-5	264.5	<0.3	<0.4	11.8	<0.2
TA-14-35-SE-10	876	<0.3	2.2	7.6	<0.2
TA-14-35-SE-25	429.6	<0.3	<0.4	0.7	<0.2
TA-14-35-SE-50	59.9	2.1	<0.4	<0.4	<0.2
TA-14-35-SE-100	5.6	2.1	<0.4	<0.4	<0.2
TA-14-35-S-5	521	<0.3	3.7	38	<0.2
TA-14-35-S-10	243.2	<0.3	<0.4	0.7	<0.2
TA-14-35-S-25	17.4	2.1	<0.4	<0.4	<0.2
TA-14-35-S-50	61.2	2.2	<0.4	<0.4	<0.2
TA-14-35-S-100	264.4	<0.3	<0.4	<0.4	<0.2

TA-14-35-S-10R	98.4	<0.3	<0.4	<0.4	<0.2
SAMPLE	**HMX μg/g**	**RDX μg/g**	**TETRYL μg/g**	**TNT μg/g**	**2,4 DNT μg/g**
TA-14-35-SW-5	231.6	<0.3	<0.4	1.4	<0.2
TA-14-35-SW-10	371	<0.3	<0.4	<0.4	<0.2
TA-14-35-SW-25	188.9	<0.3	<0.4	<0.4	<0.2
TA-14-35-SW-50	1.5	1.6	<0.4	<0.4	<0.2
TA-14-35-SW-100	2.2	4.3	<0.4	<0.4	<0.2
TA-14-35-UD-117	64.7	1.2	<0.4	<0.4	<0.2
TA-14-35-LD-133	1.1	2.4	<0.4	<0.4	<0.2
SAMPLE	**HMX ug/ml**	**RDX ug/ml**	**TETRYL ug/ml**	**TNT ug/ml**	**2,4 DNT ug/ml**
TA-14-35-RINSATE	<0.3	<0.3	<0.4	<0.4	<0.2

REPORT NUMBER: 20099

Sr-90

********** EM-9 ANALYTICAL REPORT ***********

Prepared by: DK on 24-Aug-1993

ANALYSIS: SR-90 REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: PC ANALYTICAL PROCEDURE: ER 190 NOTEBOOK: 0 PAGE: 0

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-0-0	93.04845	0.1	0.2	PCI/G	8/06/93	< 0.88 U.L.B.
14-35-E-5	93.04846	0.0	0.2	PCI/G	8/06/93	
14-35-E-10	93.04847	0.0	0.2	PCI/G	8/06/93	
14-35-E-25	93.04848	0.1	0.2	PCI/G	8/06/93	within
14-35-E-50	93.04849	0.2	0.2	PCI/G	8/06/93	
14-35-E-100	93.04850	0.0	0.3	PCI/G	8/06/93	all are ~~below~~
14-35-E-10R	93.04851	0.0	0.2	PCI/G	8/06/93	
14-35-SE-5	93.04852	0.0	0.2	PCI/G	8/06/93	U.L. Background
14-35-SE-10	93.04853	0.1	0.2	PCI/G	8/06/93	
14-35-SE-25	93.04854	0.0	0.2	PCI/G	8/06/93	
14-35-SE-50	93.04855	0.0	0.2	PCI/G	8/06/93	
14-35-SE-100	93.04856	0.1	0.2	PCI/G	8/06/93	ok
14-35-SW-5	93.04857	0.0	0.2	PCI/G	8/06/93	
14-35-SW-10	93.04858	0.0	0.2	PCI/G	8/06/93	
14-35-SW-25	93.04859	0.1	0.2	PCI/G	8/06/93	
14-35-SW-50	93.04860	0.1	0.2	PCI/G	8/06/93	
14-35-SW-100	93.04861	0.4	0.2	PCI/G	8/06/93	
14-35-S-5	93.04862	0.0	0.2	PCI/G	8/06/93	
14-35-S-10	93.04863	0.1	0.2	PCI/G	8/06/93	
14-35-S-25	93.04864	0.2	0.2	PCI/G	8/06/93	
14-35-S-50	93.04865	0.4	0.2	PCI/G	8/06/93	
14-35-S-10R	93.04866	0.1	0.2	PCI/G	8/06/93	
14-35-S-100	93.04867	0.2	0.2	PCI/G	8/06/93	
14-35-UD	93.04868	0.3	0.2	PCI/G	8/06/93	
14-35-LD	93.04869	1.1	0.3	PCI/G	8/06/93	✓ < 0.88 U.L.B

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: DK on 24-Aug-1993

REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this sample batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04908	6.1	0.4	PCI/G	6.4	0.19	8/06/93	UNDER CONTROL
93.04909	21.9	1.4	PCI/G	22.6	0.7	8/06/93	UNDER CONTROL
93.04910	0.0	0.2	PCI/G	12.8	0.4	8/06/93	OUT OF CONTROL *

* Sample aliquot may not have been spiked by QAOM. mag 8/24/93

REPORT NUMBER: 20099

SJG	DK	DK	mag
Analyst	Reviewer	Section Leader	QA Officer
8/25/93	8-24-93	8-24-93	8-24-93
Date	Date	Date	Date

Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

REPORT NUMBER: 19043

Tran U

*********** EM-9 ANALYTICAL REPORT ************

Prepared by: AS on 23-Jun-1993

ANALYSIS: U REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: KPA ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-0-0	93.04845	2.32	0.16	UG/G	6/23/93	
14-35-E-5	93.04846	5.17	0.36	UG/G	6/23/93	
14-35-E-10	93.04847	2.27	0.16	UG/G	6/23/93	
14-35-E-25	93.04848	3.34	0.23	UG/G	6/23/93	2.27 to 6.4 ppm
14-35-E-50	93.04849	4.23	0.3	UG/G	6/23/93	$\bar{x}$ = 4.33 (± 1.43)
14-35-E-100	93.04850	4.55	0.32	UG/G	6/23/93	
14-35-E-10R	93.04851	6.4	0.45	UG/G	6/23/93	
14-35-SE-5	93.04852	5.65	0.4	UG/G	6/23/93	
14-35-SE-10	93.04853	31.16	2.18	UG/G	6/23/93	1.8 to 31.16 ppm
14-35-SE-25	93.04854	4.88	0.34	UG/G	6/23/93	$\bar{x}$ = 9.44 (± 12.2)
14-35-SE-50	93.04855	3.69	0.26	UG/G	6/23/93	
14-35-SE-100	93.04856	1.8	0.13	UG/G	6/23/93	
14-35-SW-5	93.04857	4.42	0.31	UG/G	6/23/93	
14-35-SW-10	93.04858	7.36	0.52	UG/G	6/23/93	3.63 to 7.36 ppm
14-35-SW-25	93.04859	5.31	0.37	UG/G	6/23/93	$\bar{x}$ = 4.90 (± 1.53)
14-35-SW-50	93.04860	3.63	0.25	UG/G	6/23/93	
14-35-SW-100	93.04861	3.74	0.26	UG/G	6/23/93	
14-35-S-5	93.04862	5.06	0.35	UG/G	6/23/93	
14-35-S-10	93.04863	4.49	0.31	UG/G	6/23/93	
14-35-S-25	93.04864	2.09	0.15	UG/G	6/23/93	1.99 to 6.22 ppm
14-35-S-50	93.04865	1.99	0.14	UG/G	6/23/93	$\bar{x}$ = 4.33 (± 1.89)
14-35-S-10R	93.04866	6.22	0.44	UG/G	6/23/93	
14-35-S-100	93.04867	6.13	0.43	UG/G	6/23/93	
14-35-UD	93.04868	2.45	0.17	UG/G	6/23/93	Drainage < 3.34 B.G.
14-35-LD	93.04869	2.73	0.41	UG/G	6/23/93	

Rep Rep

*********** EM-9 QUALITY ASSURANCE REPORT **********

Prepared by: AS on 23-Jun-1993

REQUEST NUMBER: 14403 MATRIX: SS ANALYST: RICHARD PETERS PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

____ Only qualitative data requested

____ Only Blind QC samples run with this sample batch.

____ No QC samples run with this sample batch.

____ No QC samples for this constituent and matrix type available within EM-9

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04905	0.676	0.047	UG/G	1.11	0.02	6/23/93	OUT OF CONTROL
93.04906	1.472	0.103	UG/G	2.38	0.07	6/23/93	OUT OF CONTROL
93.04907	1.429	0.69	UG/G	1.11	0.05	6/23/93	UNDER CONTROL

REPORT NUMBER: 19043

AS	DK	DK	mag
Analyst	Reviewer	Section Leader	QA Officer
9/22/93	9-23-93	9-23-93	9-23-93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1986,' LA-11114-MS, pp. 3-4.

*********** EM-9 ANALYTICAL REPORT ***********

Prepared by: DMH on 18-Sep-1993

ANALYSIS: U REQUEST NUMBER: 14403 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

ANALYTICAL TECHNIQUE: ICPMS ANALYTICAL PROCEDURE: 200.8 NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
14-35-RIN	93.04870	12.	1.	UG/L	6/04/93	

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: DMH on 18-Sep-1993

REQUEST NUMBER: 14403 MATRIX: W ANALYST: CYNTHIA MAHAN PROGRAM CODE: M106

OWNER: Philip R. Fresquez GROUP: EM-8 MAIL-STOP: K490 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00895	1.	1.	UG/L	0.0		6/18/93	UNDER CONTROL
00.22907	82.9	25.	UG/L	100.	10.	6/18/93	UNDER CONTROL
00.22907	80.2	39.	UG/L	100.	10.	6/18/93	UNDER CONTROL
00.22907	88.8	14.	UG/L	100.	10.	6/18/93	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
93.04911	149.	14.	UG/L	140.	6.	6/04/93	UNDER CONTROL

REPORT NUMBER: 20599

[signature]	[signature]	[signature]	mag
Analyst	Reviewer	Section Leader	QA Officer
9/20/93	9/20/93	9/20/93	9/20/93
Date	Date	Date	Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

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Appendix G

Background Sample Data and Locations from "Environmental Surveillance at Los Alamos During 1995"

LA-13210-ENV

UC-902
Issued: October 1996

Environmental Surveillance at Los Alamos during 1995

Environmental Surveillance Program:
Air Quality, ESH-17
Water Quality and Hydrology, ESH-18
Hazardous and Solid Waste, ESH-19
Ecology, ESH-20

Los Alamos
NATIONAL LABORATORY

Los Alamos, New Mexico 87545

Tables 6-3. Total Recoverable Trace and Heavy Metals (μg/g) in Soils Collected in 1995[a]

Location	Ag	As	Ba	Be	Cd	Cr	Hg	Ni	Pb	Sb	Se	Tl
Off-Site Regional (Background) Stations:												
Rio Chama	3.1	0.9	36.0	<0.08[b]	<0.4	2.8	0.04	2.9	<8.0	<0.3	0.2	<0.3
Embudo	<3.0	2.0	120.0	0.44	<0.4	11.0	0.05	7.8	<14.0	<0.3	0.5	<0.3
Otowi	<3.0	2.0	150.0	0.37	<0.4	9.2	0.04	5.1	18.0	<0.3	0.5	<0.3
Santa Cruz	<3.0	4.0	140.0	0.47	<0.4	13.0	0.04	9.0	12.0	<0.3	0.6	<0.3
Cochiti	<3.0	3.0	110.0	0.30	<0.4	8.0	0.04	5.0	9.8	<0.3	0.4	<0.3
Bernalillo	<3.0	4.0	160.0	0.63	<0.4	13.0	0.05	9.9	16.0	<0.3	0.8	<0.3
Jemez	<3.0	3.0	86.0	0.32	<0.4	8.4	0.05	4.0	<14.0	<0.3	0.4	<0.3
Mean (±2SD)	<3.0 (0.1)	2.6 (2.8)	114.6 (85.7)	<0.37 (0.34)	<0.4 (0.0)	9.3 (7.1)	0.04 (0.01)	6.2 (5.3)	<13.1 (6.9)	<0.3 (0.0)	0.5 (0.4)	<0.3 (0.0)
RSRL[c]	<4.4	6.0	220.0	<0.90	<0.5	17.4	<0.05	<14.8	<21.8	<0.4	<2.0	<2.4
SAL[d]	400.0	6.0	5,600.0	0.90	80.0	400.0	24.00	1,600.0	500.0	32.0	400.0	6.4
Off-Site Perimeter Stations:												
Sportsman's Club	<3.0	4.0	120.0	0.56	<0.4	11.0	0.05	6.0	19.0	<0.3	0.5	<0.3
North Mesa	<4.0	4.0	120.0	0.64	<0.4	13.0	0.06[e]	<3.0	26.0[e]	<0.3	0.5	<0.3
TA-8	<3.0	4.0	76.0	0.40	<0.4	10.0	0.06[e]	3.4	25.0[e]	<0.3	0.4	<0.3
TA-49	<3.0	4.0	150.0	0.63	<0.4	12.0	0.04	6.2	22.0[e]	<0.3	0.4	<0.3
White-Rock	<3.0	3.0	120.0	0.79	<0.4	12.0	0.04	6.7	19.0	<0.3	0.5	<0.3
Tsankawi	<3.0	1.0	47.0	0.68	<0.4	5.3	<0.40	<2.0	25.0[e]	<0.3	0.3	<0.3
Mean (±2SD)	<3.2 (0.8)	3.3 (2.4)	105.5 (74.3)	0.62 (0.26)[f]	<0.4 (0.0)	10.6 (5.5)	<0.05 (0.02)	<4.6 (4.0)	22.7 (6.3)[f]	<0.3 (0.0)	0.4 (0.2)	<0.3 (0.0)
On-Site Stations:												
TA-21	<3.0	3.0	91.0	0.74	<0.4	11.0	0.05	5.1	40.0[e]	<0.3	0.4	<0.3
East of TA-53	3.5	1.0	22.0	0.27	<0.4	2.7	0.04	<2.0	19.0	<0.3	0.3	<0.3
TA-50	<3.0	3.0	110.0	0.53	<0.4	8.6	0.07[e]	3.7	15.0	<0.3	0.4	<0.3
2-Mile Mesa	<3.0	4.0	81.0	0.47	<0.4	9.6	0.05	4.6	22.0[e]	<0.3	0.4	<0.3
East of TA-54	<3.0	2.0	92.0	0.65	<0.4	8.4	0.04	2.9	13.0	<0.3	0.4	<0.3
R-Site-RD-E	<4.0	4.0	170.0	0.74	<0.4	11.0	0.05	<6.0	21.0	<0.3	0.4	<0.3
Potrillo-DR	<3.0	4.0	150.0	0.93[e]	<0.4	14.0	0.05	9.2	21.0	0.3	0.4	<0.3
S-Site	<4.0	3.0	150.0	0.74	<0.4	8.8	0.05	4.3	14.0	<0.3	0.5	<0.3
Near Well D-T9	<4.0	3.0	120.0	0.73	<0.4	10.0	0.05	5.7	14.0	<0.3	0.4	<0.3
Near TA-33	<4.0	3.0	110.0	0.54	<0.4	8.2	0.04	7.8	21.0	<0.3	0.4	<0.3
Mean (±2SD)	<3.5 (1.0)	3.0 (1.9)	109.6 (84.8)	0.63 (0.37)[f]	<0.4 (0.0)	9.2 (5.8)	0.05 (0.02)	<5.1 (4.3)	20.0 (15.7)[f]	<0.3 (0.0)	0.4 (0.1)	<0.3 (0.0)

[a] Analysis by EPA Method 3051 for total recoverable metals.

[b] The less than symbol (<) means the analysis was below the specified detection limit of the analytical method.

[c] Regional Statistical Reference Level; this is the upper-limit background concentration (mean + 2 std dev) from Fresquez 1995.

[d] SAL (Los Alamos National Laboratory Screening Action Level).

[e] Higher than the RSRL.

[f] Statistically significant mean from background mean using a Wilcoxon Rank Sum test at the 0.05 probability level.

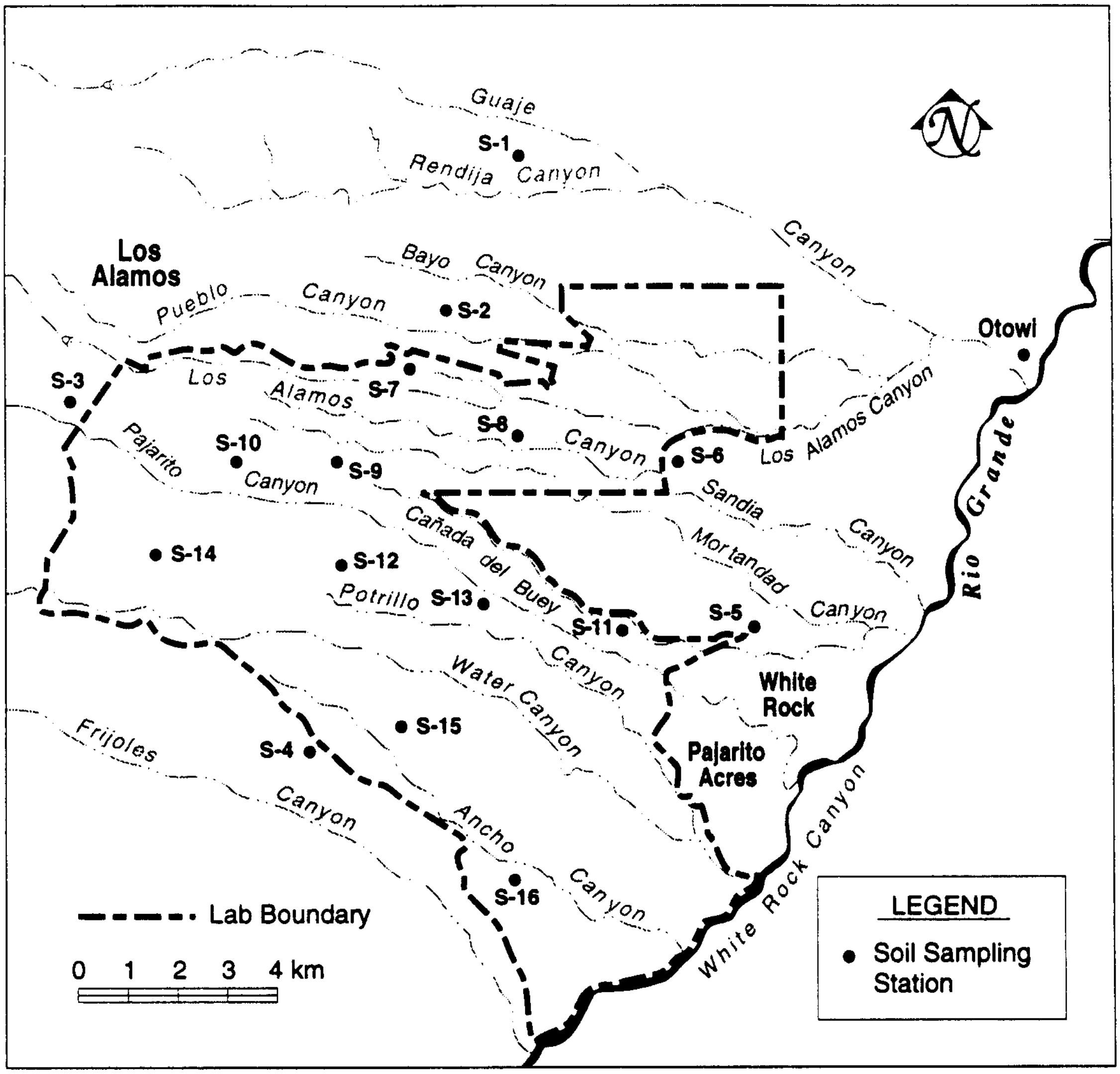

Figure 6-2. Off-site perimeter and on-site Laboratory soil sampling locations. (Map denotes general locations only. Refer to Table 6-1 for specific coordinates.)

D. Tables

Table 6-1. Location of Soil Sampling Stations[a]

Location	Map Denotation	Northing Coordinate[b]	Easting Coordinate[b]
Regional			
Rio Chama		1844693.096	1677875.228
Embudo		1816440.315	1744693.086
Otowi		1777182.637	1668721.670
Near Santa Cruz		1816438.561	1744700.759
Cochiti		1644216.892	1647114.194
Bernalillo		1572864.707	1549601.021
Jemez		1719495.437	1502276.101
Perimeter			
L.A. Sportsman Club	S1	1788136.211	1636493.387
North Mesa	S2	1780072.446	1630330.015
Near TA-8 (GT Site)	S3	1768805.627	1609433.446
Near TA-49	S4	1755456.289	1620318.345
White Rock (East)	S5	1758301.447	1655116.466
Tsankawi	S6	1768110.302	1647985.099
On-Site			
TA-21 (DP Site)	S7	1774989.218	1631266.389
East of TA-53	S8	1772914.010	1629196.631
TA-50	S9	1769548.575	1626390.047
Two-Mile Mesa	S10	1769494.453	1615386.422
East of TA-54	S11	1757882.733	1645162.755
R-Site Road East	S12	1761923.229	1625863.108
Potrillo Drive	S13	1759475.770	1635153.829
S-Site (TA-16)	S14	1759328.803	1618868.688
Near Test Well DT-9	S15	1752337.978	1629594.961
Near TA-33	S16	1740806.015	1638487.987

[a]Soil sampling locations are given in Figures 6-1 and 6-2.
[b]New Mexico State Planar Coordinates, NAD 1983.

Appendix H

Air Quality Impact Modeling for the Open Burning Unit at Technical Area 14 (included as Attachment D of Los Alamos National Laboratory's Five-Year Open Burn Permit Application, approved by the New Mexico Environment Department Air Quality Bureau on August 18, 1997.)

ATTACHMENT D

TECHNICAL APPROACH TO ESTIMATING EMISSIONS FROM OPEN BURNING OPERATIONS CONDUCTED AT TECHNICAL AREAS 11, 14, 16, AND 36

The following is a comprehensive analysis which provides detailed emission estimates for wood and fuel fire testing conducted at TA-11, HE contaminated waste burning at TA-14, equipment flashing and HE contaminated solvent/oil burning at TA-16, and DU contaminated wood waste burning and wood fire testing conducted at TA-36. Also, provided in this section are the impact analysis results from open burning emissions.

This analysis is organized into two sections: 1.) Emission Estimates from Open Burning Operations, and 2.) Ambient Air Quali· Emission Impact Analysis.

Radioactive air emission estimates and the resulting dose to the nearest off-site receptor from the burning of depleted uranium is included in this analysis for completeness and as a courtesy.

SECTION 1 - EMISSION ESTIMATES FROM OPEN BURNING OPERATIONS

Open Burning of Wood

Air emissions from the combustion of wood were derived using emission factors developed by the Environmental Protection Agency (EPA) and found in AP-42 in the July 1995, Version 4.0 of Air Chief; available on CD ROM. Specifically, the combustion of wood in residential fireplaces with no emission control devices.

Additional Information:

TA-16 HE Contaminated Solvent/Oil Burning

Because of the high combustion temperatures required to sustain burning of very dilute liquid mixtures, a wood fire may be built under the 3 foot tall burn tray and continually stoked until the HE contaminated liquids have been combusted. Wood is used only occasionally during this operation as an aid in the combustion of very dilute solvent/oil mixtures. This analysis conservatively assumes wood is present at every burn.

TA-36 Open Burn Area
Air emissions estimates for open burning of firing site wastes are based on a wood pile size of 300m^3. The quantity of wood available for burning was estimated by assuming that the loosely piled mound consisted of 25% by volume wood, density of 0.5 g/cm^3 (from CRC Handbook of Chemistry and Physics, 62nd edition, p. F-1). The amount of DU present in the wood waste was estimated using monitoring studies and predictive methods.

Open Burning of High Explosives
In all operations containing HE contaminated waste, the quantity of HE is minimal with respect to the amount of the other associated combustible waste. Although the burning of HE is not regulated, combustion emissions are included in this analysis for completeness of impact modeling.

Emission estimates for the combustion of HE were performed using emission factors compiled from data provided in the documents titled: "Emissions from the Open Burning or Detonation of High Explosives," R.V. Carter, U.S. Army Environmental Hygiene Agency, 1978; "Air Quality Impact Analysis, Open Burning of Explosives," Department of Energy, Pantex Plant, Amarillo, Texas, Radian Corp., 1990; "Lawrence Livermore National Laboratory (LLNL) Explosives Handbook Properties of Chemical Explosives and Explosive Simulants," B. M. Dobratz, 1981. Table 1 shows the typical profile of the HE burned at the Laboratory as well as their associated emissions.

TABLE 1, EMISSIONS FROM THE OPEN BURNING OF HIGH EXPLOSIVES

High Explosives, Propellants, and Binders	Composition Fraction	Quantity Burned (lb/burn)	Combustion Products (lb)		
			CO	NOx	PM
TATB[1,2]	0.21	0.42	1.09E-02	2.92E-02	8.17E-02
NTO[1,2]	0.18	0.36	1.01E-02	2.70E-02	7.56E-02
Pyroxylin[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
Comp B[1,2]	0.04	0.08	2.00E-04	1.48E-03	N/A
LAX 112[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
RDX[1,2]	0.04	0.08	2.09E-04	1.50E-03	N/A
DNT[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
Nitroguanidine[1,2]	0.04	0.08	2.22E-04	1.50E-03	2.34E-03
HMX[1,2]	0.04	0.08	2.22E-04	1.50E-03	2.34E-03
PETN[1,2]	0.04	0.08	2.00E-04	1.48E-03	N/A
TNT[1,2]	0.04	0.08	2.24E-03	6.00E-03	1.68E-02
HNS[1,2]	0.04	0.08	2.18E-04	1.15E-03	6.48E-03

Barium nitrate[3,4]	0.01	0.02	N/A	7.00E-03	N/A
Cyanuric acid[3,4]	0.01	0.02	2.20E-03	1.76E-02	1.76E-02
Pentek[3,4]	0.01	0.02	2.20E-03	1.76E-02	1.76E-02
Exxon461[3,4]	0.02	0.04	1.00E-03	N/A	N/A
KFE[3,4]	0.02	0.04	1.00E-03	N/A	N/A
Polystyrene[3,4]	0.02	0.04	2.20E-03	N/A	N/A
Estane[3,4]	0.02	0.04	2.20E-03	N/A	N/A
Viton[3,4]	0.02	0.04	1.00E-03	N/A	N/A
BDNPA-F[3,4]	0.02	0.04	2.20E-03	N/A	N/A
DBP[3,4]	0.02	0.04	2.20E-03	N/A	N/A
DOP[3,4]	0.02	0.04	2.20E-03	N/A	N/A
CEF[3,4]	0.02	0.04	1.00E-03	N/A	N/A
TOTAL	**1**	**2**	**5.06E-02**	**1.31E-01**	**2.71E-01**

1 Emission factors from Roy V. Carter (June 1978), Emissions from the Open Burning and Detonation of Explosives.

2 Emission factors from U.S. Environmental Protection Agency (July 1995), AP-42 Air Pollution Emission Factors.

3 Emission factors from Radian Corp. (July 1990), Air Quality Impact Analysis, Open Burning of Explosives, Department of Energy, Pantex Plant, Amarillo, Texas.

4 Emission factors based on chemical structures from B. M. Dobratz (March 1981), LLNL Explosives Handbook Properties of Chemical Explosives and Explosive Simulants.

Open Burning of Associated Waste

Emissions from the associated waste burned during operations (i.e. paper, plastic, Kimwipes, Lexan or Plexiglas, burlap, etc.) was derived from the burning of municipal waste published in the Environmental Protection Agency's (EPA) Air Chief 4.0 CD ROM (a.k.a. Compilation of Air Pollutant Emission Factors AP-42, 1995). Emissions from the burning of distillate oil to account for the kerosene used as a starter aid was derived from emission factors provided in EPA's AP-42, Section 1.3 (Fuel Oil Combustion).

Open Burning of HE Contaminated Solvents or Oil

High explosives (HE) contaminated dilute solvents and lubricant oils are burned in a liquid burn tray at the TA-16 burn grounds and in solvent coated rags at the TA-14 burn cage. The average composition of the solvent solutions burned at LANL are: 30% methanol; 25% water; 20% acetonitrile; 20% tetrahydrofuran; and 5% of any the solvents shown in Table 2 (Sandoval, LANL-1995) . Table 2 also gives the chemical properties and assumptions required for the emission calculations. Combustion emissions except for NOx are estimated from a study performed by A. Tewarson entitled Prediction of Fire Properties of Fuels, Factory Mutual

Research Corporation, 1985 (Attachment E). NOx emissions were estimated from emission factors provided in EPA's AP-42, Section 1.3 (Fuel Oil Combustion).

TABLE 2, CHEMICAL PROPERTIES OF SOLVENTS AND PUMP OIL

SOLVENT TYPE	MOLECULAR WEIGHT (g/mole)	DENSITY (g/ml)	NUMBER OF CARBONS	ASSUMPTIONS USED FOR CALCULATIONS
pump oil*	72	0.9050	5	**
methanol	32	0.7914	1	experimental data available
acetonitrile	41	0.7868	2	C_2 linear alkanes
tetrahydrofuran	72	0.8888	4	C_3-C_6 linear ketones
methyl ethyl ketone	72	0.8054	4	C_3-C_6 linear ketones
butyl acetate	116	0.8825	6	C_5-C_{10} acetate
ethyl acetate	88	0.9003	4	C_4 acetate
toluene	92	0.8669	7	experimental data available
ethanol	46	0.7893	2	experimental data available
acetone	58	0.7899	3	experimental data available
cyclohexane	84	0.7785	6	C_5 -C_{10} cyclo alkane

* Approximated as n-Pentane (C_5H_{12}).

** Used average of values given for linear, branched, and cyclic alkanes (paraffins).

Depleted Uranium Emission Estimates

A study conducted by Pacific Northwest Laboratory found the fractional airborne release of uranium during controlled burning to be between 0.05 and 0.003 percent of the uranium mass burned. An open burning emission study was conducted at LANL in 1980 titled, *'Oxidation of Depleted Uranium Penetraters and Aerosol Dispersal at High Temperatures'*. This study measured the amount of aerosolized DU during open burning using wood and paper as fuel. The study indicated that at temperatures ranging from 500 °C to 1000 °C, aerosol concentrations of DU in the respirable size range (<10μm) are typically less than 0.001 percent of the DU mass burned. The average fuel fire burn temperature is estimated to be 1000 °C.

Additional Information:

TA-11 Fuel and Wood Fire Testing and TA-36 Wood Fire Testing

These tests are performed to in order to study the effects fire will have on transportation packing devices and explosive test assemblies. Test assemblies may contain as much as 40 kg of DU.

TA-36 Open Burn Area

Wood consisting primarily of shot tables and stands used during detonation testing at the Laboratory's explosives sites. Tables and shot stands aid in holding or securing assemblies for detonation. Some of these assemblies contain DU. When detonated, particles and shrapnel may become lodged in the wood. The majority of the explosive testing performed involves projectile firing. It is estimated that over 98 % of the DU projectile strikes a predetermined target. Monitoring studies confirm that volumes of 20 cords of firing site debris (wood from tables and shot stands) can contain as much as 50 grams of DU lodged as shrapnel. Air emissions estimates for open burning of firing site wastes are based on a wood pile size of $300m^3$. The quantity of wood available for burning was estimated by assuming that the loosely piled mound consisted of 25% by volume wood, density of 0.5 g/cm^3 (from CRC Handbook of Chemistry and Physics, 62nd edition, p. F-1).

Emissions Summary

Table 3 summarizes the analysis used to estimate emissions from the open burning operations included in the attached application. Table 4 provides a detailed summary of emissions from open burning operations on a per burn basis.

Burn times approximate the average burn time length and are not intended to be used as terms or conditions of the permit.

TABLE 3, EMISSIONS ANALYSIS (continued)

		40 kg DU	1980 LANL Study 'Oxidation of Depleted Uranium Penetrators'	10^{-03} % of mass burned
		45 kg HE material	U.S Army Environmental Hygiene Agency, 1978, 'Emissions From the Open Burning or Detonation of Explosives'	CO 48.56 lb/ton NOx 126.5 lb/ton PM-10 4.82 lb/ton
TA-14	Burn Cage *Burn time 1 hour*	13 lb (see type and quantity of material section) wood/ cardboard	AP 42, Wood Combustion in Residential Fireplaces, July 1995, Version 4.0 of EPA's Air Chief	CO 252.6 lb/ton NOx 2.6 lb/ton SOx 0.4 lb/ton PM-10 34.6 lb/ton
		35 lb (see type and quantity of material section) plastic/ paper	AP 42 Burning of Municipal Waste, July 1995, Version 4.0 of EPA's Air Chief	CO 85 lb/ton NOx 6 lb/ton SOx 1.0 lb/ton PM 16 lb/ton
		2 lb HE	U.S Army Environmental Hygiene Agency, 1978, 'Emissions From the Open Burning or Detonation of Explosives'	CO 48.56 lb/ton NOx 126.5 lb/ton PM-10 4.82 lb/ton
		½ gal fire starter aid/fluid	Factory Mutual Research Corporation, 1986, A. Tewarson, 'Prediction of Fire Properties of Fuels'	CO 0.014 lb/gal NOx 0.66 lb/gal PM 0.177 lb/gal

TABLE 4, EMISSIONS SUMMARY (continued)

TA	BURN TYPE	MATERIAL	QUANTITY	CO (lb)	NOx (lb)	SOx (lb)	PM-10 (lb)	DU (gr)
14	Burn Cage	*wood/cardboard*	13 lb	1.6	0.02	0.003	0.2	
		plastic/paper	35 lb	1.5	0.1	0.02	0.3	
		HE	2 lb	0.05	0.1		0.005	
		fire starter aid/fluid	½ gal	0.01	0.3		0.1	
	SUM			***3.3***	***0.5***	***0.02***	***0.6***	***0***
16	Flash Pad	*wood*	1600 lb	202.1	2.1	0.3	27.7	
		rags/paper	50 lb	2.1	0.2	0.03	0.4	
	SUM			***204.2***	***2.2***	***0.3***	***28.1***	***0***
	using propane	*propane*	100 lb	0.4	0.03	0.006	0.08	
		rags/paper	50 lb	2.1	0.2	0.03	0.4	
	SUM			***2.5***	***0.2***	***0.04***	***0.5***	***0***
	Solvent Burn	*solvent*	55 gal	0.8	36.3	0	9.7	
		oil	55 gal	1.6	0	0	16	
		scrap wood	1600 lb	202.1	2.1	0.3	27.7	
	SUM			***204.5***	***38.4***	***0.3***	***53.4***	***0***
	using propane	*propane*	100 lb	0.04	0.003	0.0006	0.008	
		solvent	55 gal	0.8	36.3	0	9.7	
		oil	55 gal	1.6	0	0	16	
	SUM			***2.44***	***36.303***	***0.0006***	***25.708***	***0***
36	Wood Burn	*wood*	83000 lb	10482.9	107.9	16.6	1435.9	
		Lexan	250 lb	10.6	0.75	0.125	2	
		diesel or kerosene	10 gal	0.3			2.9	
		DU	55 gr					0.00055
	SUM			***10493.8***	***108.7***	***16.7***	***1440.8***	***0.00055***
	Sled Track Test	*wood*	2000 lb	252.6	2.6	0.4	34.6	
		HE	99 lb	2.4	6.3		0.2	
		DU	40000 gr					0.4
	SUM			***255***	***8.9***	***0.4***	***34.8***	***0.4***

SECTION 2 - AMBIENT AIR QUALITY EMISSION IMPACT ANALYSIS

Air emission impacts from open burning are regulated under ambient air quality standards set forth by federal statutes and adopted by the State of New Mexico. Air emissions from LANL's open burning operation include criteria pollutants such as carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM), and sulfur dioxide (SO_2). In addition, impacts from depleted uranium (DU) must meet the NESHAP standards for radionuclide emissions as set forth in 40 CFR 61 Subpart H, *emissions of radionuclides from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem.*

Compliance with the ambient air quality standards was determined using the SCREEN 3 air emissions dispersion model. Impact estimates from DU was determined using the *HOTSPOT 8.0* emissions dispersion model.

Results of the impact analysis, the parameters supplied to the modeling programs, and the applicable standard for each regulated pollutant are shown in Tables 7 - 12 for both the maximum impact and for the nearest off-site location for each open burn operation. The impacts from **all** regulated pollutants are shown to be well below the ambient standards at **all** affected locations.

Air Quality Impacts

Criteria Pollutants

Air quality impacts of the combustion products CO, NOx, SO_x, and PM were assessed at the maximum impact points and the nearest off-site receptors for each open burn operation. Compliance with the standard was evaluated using the SCREEN 3 air emissions dispersion model. The SCREEN 3 model was developed and approved by EPA as a screening procedure for estimating air quality impacts of stationary sources. SCREEN 3 is a conservative model which uses worst case meteorological data to determine emission impacts. In addition, the SCREEN 3 model assumes that emissions from a source or operation is continuous. Because open burning operations at LANL are intermittent with varying burn times, source terms supplied to the SCREEN 3 model were determined as follows:

- 1-hr impacts are normally estimated by the SCREEN 3 model. Emission quantities supplied to the model came from the total emissions from a single burn divided by the number of hours the burn lasted.
- 8 and 24-hr impacts were estimated by taking the 1-hr impact results and multiplying by constants developed by EPA (i.e. 0.7 and 0.4 respectively).
- The conservative impact data generated by the model assumes the emission is continuous (lasts 24 hours a day, 365 days a year).

TABLE 9, TA-14 BURN CAGE

CHEMICAL	MODELING PARAMETERS	AMBIENT AIR QUALITY STANDARD			AIR CONCENTRATION AT: 61 M (Max.)	2042 M (Pajarito Rd.)	2286 M (SR 4)
CO	D Stability	8-hour average	0.5 mg/m^3	(8.7 ppm)	0.5 ppm	4E-03 ppm	3E-03 ppm
		1-hour average	2.0 mg/m^3	(13.1 ppm)	0.8 ppm	6E-03 ppm	5E-03 ppm
NOx	60 min burn time	24-hour average	5.0 µg/m^3	(0.1 ppm)	2E-02 ppm	1E-04 ppm	9E-05 ppm
		Annual arithmetic average	1.0 µg/m^3	(0.05 ppm)	3E-03 ppm	2E-05 ppm	2E-05 ppm
PM	2.5 meters/sec. wind speed	24-hour average	150 µg/m^3		137 µg/m^3	1 µg/m^3	1 µg/m^3
		7-day average	*110 µg/m^3				
		30-day average	*90 µg/m^3				
		Annual geometric mean	60 µg/m^3		27 µg/m^3	0.2 µg/m^3	0.2 µg/m^3
SO_2	Heat Released 15,748 cal/sec.	24-hour average	5.0 µg/m^3	(0.1 ppm)	0.03 ppm	2E-04 ppm	2E-04 ppm
		Annual arithmetic average	1.0 µg/m^3	(0.02 ppm)	0.01 ppm	4E-05 ppm	4E-05 ppm

* Impacts were not averaged for standard.

TABLE 10, TA-16 FLASH PAD AND SOLVENT/OIL BURNS

CHEMICAL	MODELING PARAMETERS	AMBIENT AIR QUALITY STANDARD			AIR CONCENTRATION AT: 498 M (Max.)	1828 M (SR 4)
CO	D Stability	8-hour average	0.5 mg/m^3	(8.7 ppm)	0.5 ppm	0.2 ppm
		1-hour average	2.0 mg/m^3	(13.1 ppm)	1 ppm	0.8 ppm
NOx	120 min burn time	24-hour average	5.0 µg/m^3	(0.1 ppm)	2E-03 ppm	6E-04 ppm
		Annual arithmetic average	1.0 µg/m^3	(0.05 ppm)	0.002 ppm	3E-04 ppm
PM	2.5 meters/sec. wind speed	24-hour average	150 µg/m^3		30 µg/m^3	10 µg/m^3
		7-day average	*110 µg/m^3			
		30-day average	*90 µg/m^3			
		Annual geometric mean	60 µg/m^3		2 µg/m^3	0.4 µg/m^3
SO_2	Heat Released 15,748 cal/sec.	24-hour average	5.0 µg/m^3	(0.1 ppm)	2E-04 ppm	6E-05 ppm
		Annual arithmetic average	1.0 µg/m^3	(0.02 ppm)	7E-06 ppm	2E-06 ppm

[1] 8-hour and 24-hour evaluations took the maximum 1-hour impacts from flash burning and multiplied by the factors of 0.7 and 0.4 respectively supplied by EPA for averaging time adjustments.

[2] Annual arithmetic average and the annual geometric mean were derived by summing emissions from all burning operations and dividing by 8760 hours.

[3] The 7-day average and 30-day average were not evaluated.

N/E - No Evaluation Performed.

Appendix I

Evaluation of Meteorological Conditions for Open Burning

EVALUATION OF METEOROLOGICAL CONDITIONS FOR OPEN BURNING

Purpose

Los Alamos National Laboratory (LANL) operating groups conduct open burning operations that are permitted and approved by the New Mexico Environmental Department's Air Pollution Control Bureau. This Air Quality Group procedure describes the process used by ESH-17 to determine if wind speed, atmospheric stability, and mixing depth are within allowable limits before issuing permission to LANL operating groups to perform open burning.

Scope

This procedure applies to all open burning performed at LANL.

In this procedure

This procedure addresses the following major topics:

Signatures

Prepared by: Leland Maez, Open Burn Permitting Project Leader	Date: 3/1/96
Approved by: Pat Beaulieu, ESH-17 Quality Assurance Officer	Date: 3/1/96
Approved by: Ernie Gladney, ESH-17 Group Leader	Date: 3/4/96

02/29/96

General information about this procedure

Attachments

This procedure has no attachments.

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	3/2/96	New document.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- ESH-17 personnel assigned to assess meteorological conditions before issuing permission for open burning.

Training method

The training method for this procedure is "self-study" (reading) and is documented in accordance with the procedure for training (ESH-17-024).

Prerequisite

Access to LANL Weather Machine (Internet connection)

General information, continued

Definitions specific to this procedure

Mean wind speed: The mean wind speed is measured in meters per second at 11 meters above ground level over a 15 minute period. Wind is a factor in issuing permission for a burn because high wind speeds increase fire danger. A burn should be postponed if the mean wind speed is equal to or greater than 10 meters per second.

Atmospheric stability: Stability is classified as A, B, C, D, E, or F. Atmospheric stability controls the rate of growth of the plume. When conditions are A, B, C, or D, mixing is quite rapid and concentrations fall off quickly with distance from the source. When conditions are categorized as E or F, the decrease in concentration with distance is slower. A burn should be postponed if the stability is E or F.

Mixing depth: Mixing depth is the depth of the layer in which most of the mixing will occur. A shallow mixing layer will impede vertical growth of the plume once it has reached the top of the mixed layer. If the mixing depth is less than 200 meters, the burn should be postponed.

References

The following documents are referenced in this procedure:

- ESH-17-024, "Personnel Training"

Note

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

Obtaining and evaluating meteorological conditions

Background

In order to assure proper dispersion of the smoke generated by open burning and to minimize fire risk, meteorological conditions must be within acceptable limits. ESH-17 personnel must evaluate meteorological conditions before granting permission to operating groups to perform a burn.

Obtaining and evaluating data

To obtain and evaluate meteorological data, perform the following steps:

Step	Action
1	On the morning of the scheduled burn, log onto the LANL Weather Machine at address http://weather.lanl.gov.
2	Under "Current and Recent Conditions around Los Alamos," select "Detailed Tabular Summary, Long Form."
3	Scroll to the most recent meteorological data for the present date. If you cannot access the Weather Machine data, or the most current data is more than 30 minutes old, call an ESH-17 meteorologist at 667-7079 to obtain the required information.
4	Find the "PG Stability category EPA based on Sigma Phi" at the meteorology tower nearest to the burn site. **If the stability is...** → **Then...** A, B, C, or D → Continue with step 5 E or F → Notify the operating group that the burn must be postponed
5	Find the 11 meter height wind speed at the meteorology tower nearest to the burn site. **If the wind speed is...** → **Then...** Less than 5 m/s → Go to step 7 Equal to or greater than 5 m/s → Continue with step 6

Obtaining and evaluating met. conditions, continued

Step	Action
6	Call an ESH-17 meteorologist at 667-7079 to consult about fire danger. The meteorologist will obtain the current fire danger index and determine if the wind speed is acceptable. **If the meteorologist determines...** → **Then...** The wind speed is acceptable → Perform step 7 while in telephone contact with the meteorologist The wind speed is excessive → Notify the operating group that the burn must be postponed
7	Call an ESH-17 meteorologist at 667-7079 and request the current estimate of mixing depth. **If the mixing depth is...** → **Then...** Greater than 200 meters → Immediately notify the operating group that the burn may be performed between the hours of 10 AM and 4 PM MST and must be started within 2 hours of the evaluated meteorology data time Less than or equal to 200 meters → Notify the operating group that the burn must be postponed
8	When verbal permission has been granted to perform a burn, record the following information in the applicable section of the Open Burning Log: • Operating group personnel to whom you verbally granted burn permission • Date and time period during which the burn may be performed • Evaluated mean wind speed, atmospheric stability, and mixing height values

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be submitted as records to the records coordinator:

- When an open burning permit expires, information recorded in the Open Burning Log applicable to that permit is submitted as a record

Appendix J

Impulse Noise Measurements at Technical Area 14

TO: Michelle Cash, ESH-19 (P915)

FR: Ernie Vigil, ESH-5, (P915)

SUB: IMPULSE NOISE MEASUREMENTS AT TA-14

Impulse noise measurements of HE detonations were obtained at TA-14 on 2 separate dates; Nov. 21, 1991 (clear day) and Dec. 11, 1991 (cloud cover). The HE used was 20 lbs. of a mix of 9501 and guanidine for each shot. The following are the results of the measurements obtained.

Nov. 21, 1991

	Shot 1	Shot 2	Shot 3
Control Room	122 dB	------	125 dB
Outside Control Rm.	------	------	151 dB
Site Gate	145 dB	146 dB	144 dB
Jog Trail	140 dB	148 dB	140 dB

Dec. 11, 1991

Control Room	122 dB	120 dB	122 dB
Outside Control Rm.	151 dB	132 dB	------
Site Gate	140 dB	141 dB	148 dB
Site Fence (near gate)	148 dB	148 dB	150 dB

Note: The site gate, site fence, and the jog trail locations are in close proximity to each other. The fence location was just east of the gate with an unobstructed path to the firing mound which likely accounts for the slightly higher readings. The gate location readings may be lower due to the firing control room being in a direct line with the firing point. The distance to these locations is approximately 460-480 ft. The control room readings are inside the control room which is approximately 80-100 ft. away.